SMITH FORK PROJECT, COLORADO

COLORADO RIVER STORAGE PROJECT

A Report of reappraisal of direct agricultural benefits and project impacts

U. S. DEPARTMENT OF AGRICULTURE
Salt Lake City, Utah

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UNITED STATES DEPARTMENT OF AGRICULTURE

REPORT OF

REAPPRAISAL OF DIRECT AGRICULTURAL BENEFITS

AND PROJECT IMPACTS

SMITH FORK PROJECT

COLORADO

COLORADO RIVER STORAGE PROJECT

In Cooperation With
Bureau of Reclamation
United States Department of the Interior

Report Prepared by

USDA Field Advisory Committee & USDA Field Party

Salt Lake City, Utah - May 1958

ACKNOWLEDGMENTS

This report is based on available field data, published reports, and the combined judgement of agricultural technicians familiar with the project area, its agricultural problems and conditions. The Bureau of Reclamation furnished the USDA Field Party with preliminary reports, land classification maps and field sheets, farm worksheets, information regarding water supply, and acreage and location of lands to be included in the project.

This information is used to augment field investigations such as soil surveys, economic surveys, engineering surveys, crop yield determinations, and irrigation water investigations made by members of the USDA Field Party, Soil Conservation Service and Agricultural Research Service.

The U.S. Forest Service and U.S. Bureau of Land Management assisted in the watershed studies. The Forest Service also prepared Chapter III regarding the relationship of the project to national forest lands. Assistance from representatives of the U.S. Farmers Home Administration, Colorado State University, Colorado Cooperative Extension Service, Colorado Agricultural Experiment Station, State and County Agricultural Stabilization and Conservation Committees, and others was valuable in preparing the report.

The contributions and assistance of these organizations in the preparation of this report are gratefully acknowledged.

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SMITH FORK PROJECT - COLORADO

SUMMARY

Authority and Scope

This report of the Smith Fork project, Colorado River Storage Project has been prepared by the U.S. Department of Agriculture in response to the President's letters of March 19, 1954 to the Secretary of Agriculture and the Secretary of the Interior. In his letters, the President requested that a reappraisal of the direct agricultural benefits anticipated from the participating projects of the Colorado River Storage Project be made by the Department of Agriculture in cooperation with the Department of the Interior. Following the authorization of the Colorado River Storage Project by Congress, April 11, 1956, an understanding was reached in July 1956 between the Secretary of Agriculture and Secretary of the Interior regarding conduct of a survey to reappraise direct agricultural benefits and to appraise project impacts. The Department of Agriculture survey was made under the authority of Section 6, Public Law 566, 83rd Congress, as amended, which authorizes the Department to cooperate with other federal, state, and local agencies to make investigations and surveys of the watersheds of rivers as a basis for the development of coordinated programs.

The survey is based on the Smith Fork project plan as outlined by the Bureau of Reclamation and the reappraisal of direct agricultural benefits is confined to the proposed project facilities and the lands which they will serve.

In addition to the agricultural phases, this report deals with the impacts of the project on the national forests and the relationship of watershed conditions to the project. This report is also intended to aid the Bureau of Reclamation in developing a sound project plan and to provide information bearing on regular programs of this Department.

General Description

The Smith Fork project is located in the southeastern corner of Delta County, Colorado. Evelation of project lands varies from 5,500 to 7,200 feet; the climate is semi-arid with an average annual precipitation of about 10 inches and a frost-free period of 135-145 days.

Agriculture is the basic industry of the project area. Income is derived primarily from the sale of livestock and livestock products. Irrigated lands are used primarily for the growing of hay, grain and pasture

Proposed Project Development

The project will provide additional irrigation water supplies for 6,920 acres of presently irrigated land and 1,320 acres of nonirrigated land. Surplus flows in Iron Creek will be stored in the proposed Crawford Reservoir on that stream. Water will also be diverted from Smith Fork of the Gunnison River into this reservoir. Crawford Reservoir water will be conveyed to most of the project lands through the proposed Aspen Canal.

Evaluation of Expected Direct Agricultural Benefits

Evaluation Areas

For purposes of the analysis, project lands were grouped into five evaluation areas. The soils, climate, water supply and other physical factors in each evaluation area reflect similar crop adaptations, productivity, land development requirements and production costs.

Project lands in each evaluation area are treated as a unit in the several phases of the analysis, and farm incomes and direct agricultural benefits are determined for each evaluation area and the project as a whole.

Evaluation area A includes 1,796 acres of project lands in the upper Smith Fork Basin, upstream and east of the town of Crawford. Evaluation area B includes 2,234 acres of land on the eastern part of Grandview Mesa and on the lower Cottonwood Creek drainage. Evaluation area C includes 3,017 acres of land in the western part of Grandview Mesa. Evaluation area D comprises 540 acres of nonirrigated land on the western part of Grandview Mesa. Evaluation area E includes 653 acres of project lands along the lower Smith Fork River and those lands in the northeast portion of the project.

The 1,320 acres of nonirrigated land proposed to receive project irrigation water are interspersed throughout evaluation areas A, B, C, and D. Generally these lands will become part of existing farm units. The nonirrigated lands described in evaluation area D are analyzed separately because they constitute the largest area of nonirrigated land in the project and will probably provide the only new farm units.

Soils

Basic soils data were obtained from a standard soil survey completed by the Soil Conservation Service in 1957. Soil data tabulated from this survey covers the lands within the project boundaries delineated by the Bureau of Reclamation. Based on this survey, it is concluded that the 8,240 acres of project land, less 6 percent (494 acres) for roads, farmsteads, etc., are suitable for cultivation under irrigation.

Irrigation Supplies and Requirements

There are several comprehensive studies of irrigation requirements in the general vicinity of the Smith Fork project. These data, with additional information supplied by personnel familiar with the area, are the basis for determining irrigation water requirements. In the past, water supply shortages in the project area have ranged as high as 70 percent of requirements during years of low runoff.

Based on a weighted average seasonal consumptive use of 18.7 inches per acre and an estimated on-farm irrigation efficiency of 42 percent, the estimated farm irrigation requirement per productive acre is 44.4 inches of water. Proposed project failities will deliver an average of 42.6 inches of irrigation water at the farm headgate, thus meeting 96 percent of the water requirements of the project lands.

Land and Irrigation Development

Development requirements for project lands are estimated by evaluation areas on the basis of the average level of management expected on the project and within the limitations imposed by soils and site factors. They are consistent with anticipated irrigation efficiencies and expected crop yields. Weighted average development costs per acre of nonirrigated lands are $52.29 and for presently cultivated lands are $14.87.

Projected Agricultural Economy

The economic analysis of the proposed Smith Fork project is concerned with two primary objectives: (1) To develop estimates of potential farm incomes and (2) to estimate direct agricultural benefits. Forward budgeting of farms is used in developing estimates of both potential incomes and direct agricultural benefits. Four typical farm types -- range beef, dairy, feeder steers, and farm sheep -- are used in the analysis.

Development of the project would result in an improved agricultural economy. Adjusted farm incomes per farm are estimated to average $4,010. This amount would be available for operator and family labor and management and for payment of land and irrigation water costs.

The residual approach is used to estimate direct agricultural benefits. For analytical purposes, livestock and associated incomes are omitted from farm budgets. This approach eliminates an income and benefit problem related to processing feed through livestock enterprises and allocating returns to the appropriate resources. However, the influence of a livestock economy is reflected in higher prices for feed crops used in the farm budgets than would otherwise prevail. The weighted average direct agricultural benefits attributable to development of the Smith Fork project of 8,240 acres are estimated at $8.67 per acre or a total of about $71,400 annually.

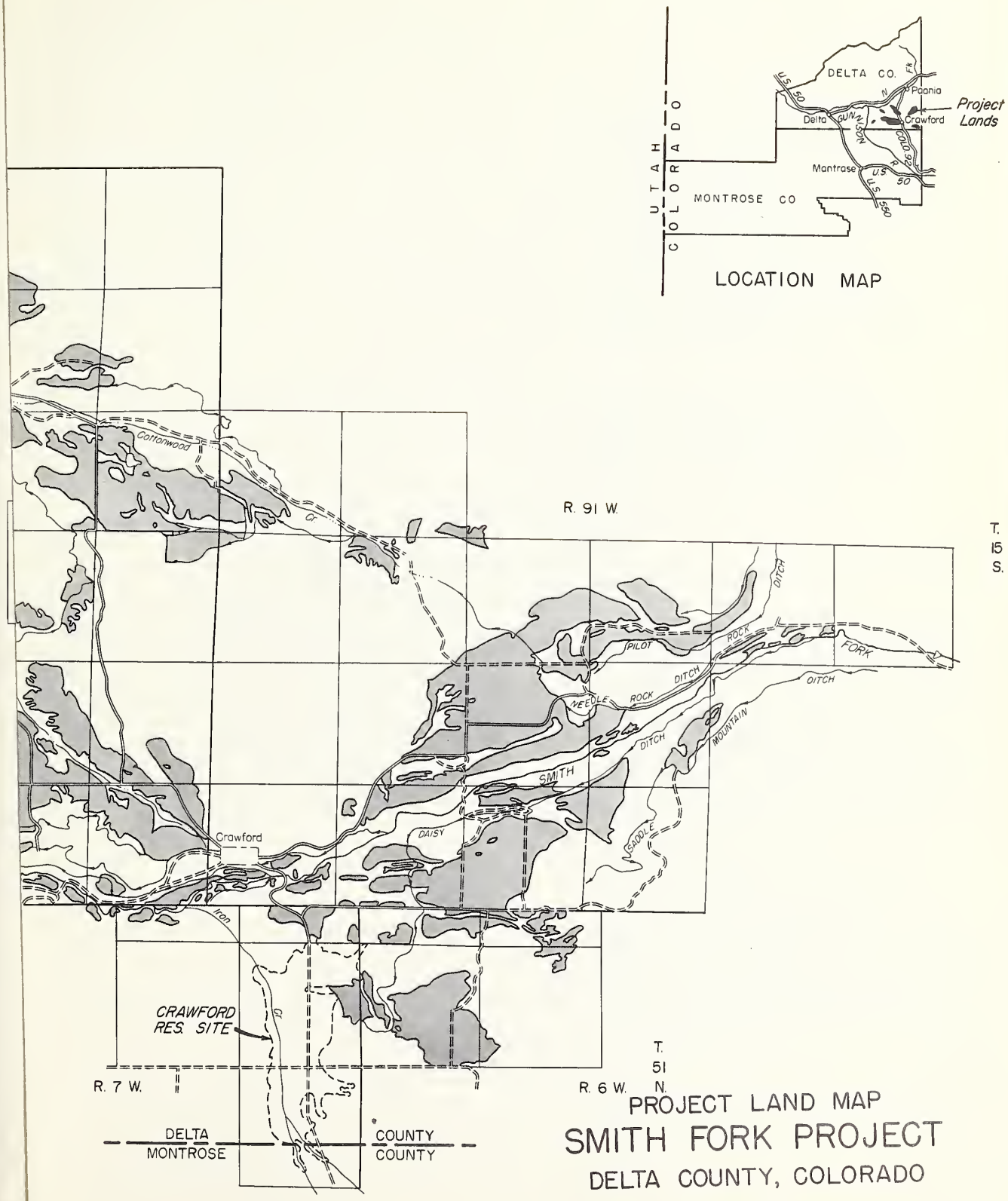
Relationship of the Smith Fork Project to National Forest Lands

The Smith Fork project will not impair any existing facility or service on national forest lands.

Relationship of Watershed Conditions to the Smith Fork Project

Watershed conditions affecting this project are those common to most western irrigation projects. They do not materially affect feasibility of the porject. However, improvement of watershed conditions will extend the life of the project and reduce operating difficulties and maintenance expenses.

The watershed area that affects the Smith Fork project includes the drainages of the Smith Fork River, Allen Gulch and Cottonwood Creek. Upper lands generally have fair to good vegetative cover while lower lying lands have fair to poor plant cover conditions. Erosion and sediment production is greater on the lower lands. Land ownership is 55 percent private and 45 percent federal. The Gould Reservoir on Iron Creek, about 4 miles above the proposed Crawford Reservoir site, tends to decrease flood peaks and sediment damage on the Iron Creek drainage. Watershed conditions do not pose a flood threat to the project, but do permit excessive amounts of sediment to be produced. Bureau of Reclamation plans for the proposed Crawford Reservoir provide for storage of the anticipated sediment. The application of land treatment measures and improved range management should be undertaken on problem areas where erosion is active. This will reduce the amount of sediment produced and prolong the useful life of the reservoir and the project. This treatment can be done under authority of regular programs. The construction of large flood control structures is not recommended.



PROJECT LAND MAP
SMITH FORK PROJECT
DELTA COUNTY, COLORADO

MARCH 1958

1 0 1 2
SCALE IN MILES

7-S-20171-N

R 92 W

R 93 W.

R 91 W

T 15 S

T. 51 N

R 7 W

R. 6 W

NORTH FORK

GUNNISON RIVER

SMITH FORK

GRAND VIEW DITCH

CRAWFORD RES SITE

Crawford

DELTA COUNTY

MONTROSE COUNTY

DELTA / MONTROSE COUNTY

LOCATION MAP

UTAH COLORADO

Project Lands

LEGEND

Project Lands

PROJECT LAND MAP

SMITH FORK PROJECT

DELTA COUNTY, COLORADO

MARCH 1958

SCALE IN MILES

DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE M-2015

7-S-20171-N

CHAPTER I

GENERAL INFORMATION

Organization

Pursuant to the U. S. Department of Agriculture Memorandum of Understanding between the Soil Conservation Service, Forest Service, and Agricultural Research Service dated February 2, 1956, a USDA Field Advisory Committee, Colorado River Storage Project was established. The committee is composed of a representative from each of the above-mentioned agencies and a member representing the concerned state agricultural colleges. Principal duties of the committee are to maintain appropriate liaison and facilitate coordination of activities by the respective services and the state agricultural colleges in the survey. Field relationships with the Bureau of Reclamation and other interested state and federal agencies are also a responsibility of the committee.

A USDA Field Party, working under direction of the USDA Field Advisory Committee and operating within a plan of work dated August 22, 1956, is headquartered at Salt Lake City, Utah. The party is responsible for the collection and analysis of data and the preparation of this report.

Description of the Area

Location and Physical Features

The Smith Fork project is located in the southeast corner of Delta County, Colorado. Project lands lie on Grandview Mesa, upper Smith Fork Basin, along Cottonwood Creek and in small scattered tracts in the lower Smith Fork Canyon. They begin in the Missouri Flat area of the upper Smith Fork Basin approximately 5 miles northeast of the town of Crawford and extend along Cottonwood Creek for approximately 10 miles, terminating near the North Fork of the Gunnison River above the town of Hotchkiss. They also extend about 12 miles west from the town of Crawford along Grandview Mesa. Elevation of project lands varies from approximately 5,500 to 7,200 feet.

The Smith Fork of the Gunnison River heads in the high peaks of the West Elk Mountains and flows westward through a deep narrow valley to its confluence with the Gunnison River approximately 15 miles west of the town of Crawford. From here, the Gunnison River flows in a northwesterly direction and joins the Colorado River near Grand Junction. Iron Creek drains into Smith Fork one-half mile southwest of Crawford. Cottonwood Creek flows through the project area and is a tributary of the North Fork of the Gunnison River.

Project lands are within the boundary of the Delta Soil Conservation District, organized May 1, 1951, and are privately owned.

Climate

The project area has a temperate, semi-arid climate which is satisfactory for irrigation farming. Dry farming has proven unsuccessful due to inadequate rainfall.

A Weather Bureau station was operated at Crawford from 1901 to 1922. This station recorded an average of 10.80 inches annual precipitation for this period. By comparison with records of stations at Paonia, Delta, and Montrose it is estimated that the average annual precipitation is slightly in excess of 10 inches. Half of this falls during the growing season.

The weather station at Crawford during the 13-year period previously mentioned recorded an average frost-free period of 137 days. By comparison with surrounding stations having a longer period of record, it is estimated that the average frost-free season for the project area varies from 135 to 145 days. The last killing frost occurrs around May 12-17 and the first killing frost around October 1-5. Maximum and minimum temperatures recorded at Crawford are 93° F and -25° F. Relative humidity is low, averaging about 40 percent.

Present Agriculture

History of Development

Western Colorado, including Delta County, was originally inhabited by Ute Indians. Early efforts of the whites to settle the area were retarded by the Indians until a compromise agreement between the United States and the Ute Indians was reached in 1881. With this agreement, settlement of the area progressed rapidly.

Early settlers found irrigation necessary for successful crop production. Natural flow from Smith Fork was first appropriated in 1883. Present appropriations exceed the available stream flow during most of the irrigation season. In addition to irrigation, water is used for domestic, stock, and recreational purposes. Water is distributed through canals and ditches throughout most of the winter months to supply stock water. No water is used for industrial purposes.

Agricultural Development

Agriculture is the basic industry of the project area and consists primarily of a livestock economy -- beef cattle, sheep, dairying, and general livestock. All farms have livestock. Some sell part of their crops. Income is derived principally from the sale of livestock and livestock products. Irrigated lands are used primarily for the growing of hay, grain, and pasture in connection with these enterprises. During the spring, summer, and fall months cattle and sheep are grazed on the adjoining national forest and public domain lands. Private rangelands are used also for grazing.

Shortages of irrigation water supplies have limited the expansion of irrigated land; consequently, there has been little new development since the initial settlement. Crop yields reflect this water shortage.

Economic Conditions

The general economy of Delta County is sound. Farmers in the project have maintained good credit ratings through frugal living and careful operation of their farming enterprises. Generally, the larger beef and sheep operators with federal range permits have a higher living level than operators of the more general dairy farming type. All farm operators have been hampered by irrigation water shortages.

Some farm operators supplement their farm income with part-time work in adjoining communities. Mining, lumbering, fruit, vegetable and sugar beet processing industries offer employment in adjacent areas. Population growth from 1900-40 was slow and fairly uniform. This was attributed largely to the division of farms into smaller units and the establishment of other enterprises. Since that time, the trend has been toward larger farm units with a downward trend in population growth. The 1940 census lists Crawford with a population of 221. The 1950 census shows a total of 170.

General

Colorado State Highway No. 92 is the main route through the project and connects Crawford with Hotchkiss and Delta. Highway distance from Crawford to Delta is 32 miles and to Grand Junction 73 miles. Crawford has no rail facilities but a branch line of the D & RGW Railroad serves nearby Hotchkiss. The Mountain States Telephone and Telegraph Company and the Delta County Cooperative Telephone Company provide telephone service. An R.E.A. cooperative, the Delta-Montrose Rural Lines Association distributes electrical power within the project area.

Recreational facilities are not highly developed at present; however, they are expected to become more important with the development of the project. The main attraction is the Black Canyon of the Gunnison which is located a few miles southwest of Crawford.

Proposed Development

The Smith Fork project will regulate surplus flows of Iron Creek and the Smith Fork of the Gunnison River and provide additional water supplies for 6,920 acres of presently irrigated land and 1,320 acres of nonirrigated land. The flows will be regulated by the proposed Crawford Reservoir on Iron Creek. Releases will be made through the Aspen Canal to serve lands on Grandview Mesa and along Cottonwood Creek. Storage water will replace some direct diversion from Smith Fork and permit use of additional direct flows in the upper Smith Fork Basin.

The Crawford Reservoir on Iron Creek, with a total initial capacity of 13,650 acre feet and an initial active capacity of 13,500 acre feet of irrigation water, would be formed by a rolled-earth and rock-fill structure approximately one mile south of the town of Crawford.

CHAPTER II

EVALUATION OF DIRECT AGRICULTURAL BENEFITS TO BE EXPECTED FROM THE SMITH FORK PROJECT

In evaluating the direct agricultural benefits to be expected from the Smith Fork project, the project plans outlined by the Bureau of Reclamation served as a basis for the study. The report is based on the proposed project facilities and the lands which they will serve.

Consideration was given to the following:

1. Project soils and their suitability for irrigation.
2. Irrigation water supplies and requirements.
3. Necessary land and farm irrigation development.
4. Evaluation areas.
5. Size and type of farming, together with anticipated crops and crop yields.
6. Farm income potentials.
7. Direct agricultural benefits.

Evaluation Areas

To facilitate the presentation of basic agricultural data and to assist in the reappraisal of direct agricultural benefits, project lands were grouped into five evaluation areas. (Table 1) The soils, climate, water supply and markets within each evaluation area reflect similar crop adaptations, productivity, land and irrigation development and production costs.

Nonirrigated lands proposed to receive project water are interspersed throughout evaluation areas A, B, C and D with the exception of the nonirrigated lands in evaluation area D. These tracts are scattered and not large enough to make new farm units so they will probably be added to existing farm units. The nonirrigated lands described in evaluation area D are analyzed separately because they consititute the largest area of nonirrigated land in the project and will probably provide the only new farm units.

Table 1. - Irrigable acreage by evaluation areas, Smith Fork project

Project lands	Evaluation areas					
	A	B	C	D	E	Total
	Acres					
Presently irrigated lands	1,684	1,916	2,667	---	653	6,920
Nonirrigated lands	112	318	350	540	---	1,320
Total	1,796	2,234	3,017	540	653	8,240

The most significant differences recognized in differentiating the evaluation areas are water supply, climate, and soils. The areas are described as follows:

Evaluation Area A - This area includes project lands in the upper Smith Fork Basin, generally east of the town of Crawford. Irrigation water is supplied by the Needle Rock, Pilot Rock and Lone Rock ditches north of the Smith Fork River, and the Saddle Mountain and Daisy ditches south of the river. Water shortages in the past have ranged from 30 percent to 45 percent of seasonal requirements. These shortages are concentrated during the months of July, August and September. These lands lie above the proposed Crawford Reservoir and will continue to receive water by direct diversion from natural flow of the Smith Fork River. Additional irrigation water will be supplied by the project in exchange with lands receiving supplemental water from the Crawford Reservoir. This area includes some lands with the highest elevation and the shortest growing season in the project.

Soils are deep with medium-textured surfaces and moderately-fine to fine-textured subsoils. They have a medium water intake rate and high water-holding capacity. Dominant slopes range from four to six percent.

Crops suited to the climate and slopes of these lands are alfalfa, pasture and small grain. Some silage corn is also grown in the area.

Evaluation Area B - This area includes the most productive of those lands located on the eastern part of Grandview Mesa and on the lower Cottonwood Creek drainage area. Irrigation water is furnished by the Clipper and Grandview ditches from direct diversions of the unregulated flows of the river. Average water shortages in the past have amounted to approximately 25 percent of requirements. Part of the area has a low priority water right and has had water supply shortages of up to 50 percent of requirements. Direct flow water will be supplemented by storage water from the Crawford Reservoir delivered through the Aspen Canal. This area includes some lands at the lowest elevations with the longest growing season in the project. Soils are generally deep to moderately deep, have a medium-textured surface, a moderately-fine to fine-textured subsoil, a medium water intake rate, and a high water-holding capacity. Dominant slopes range from three to six percent.

Evaluation area B has the most favorable climate in the project area for the production of feed crops. The largest acreage of corn silage will be grown in evaluation area B.

Evaluation Area C - This area includes project lands located on Grandview Mesa. These lands are generally interspersed with those lands of evaluation area B. Direct diversion water is furnished by the Clipper and Grandview ditches. Average water shortages in the past have amounted to about 25 percent of requirements. The direct flow water will be supplemented by storage water from the Crawford Reservoir delivered through the Aspen Canal. Evaluation area C has the same length of growing season as evaluation area B.

Soils are moderately deep with medium-textured surfaces and moderately fine to fine-textured subsoils, are underlain with poorly consolidated shales and sandstones, have a medium water intake rate and a medium water-holding capacity. The dominant slopes range from six to eight percent.

Crops will be predominately alfalfa hay and pasture with small grains being grown following the breaking out of old stands of hay or pasture and as a nurse crop for new stands. Some corn silage will be grown on the flatter slopes.

Evaluation Area D - This comprises an area of nonirrigated land located in the western part of the project on Grandview Mesa. It is the largest area of nonirrigated land in the project and will probably provide the only new farm units developed.

The Grandview ditch will furnish direct diversion water. This will be supplemented by water stored in the Crawford Reservoir delivered through the Aspen Canal. The growing season of these lands is comparable with those in evaluation areas B and C.

Soils are moderately deep, have a medium-textured surface, a moderately fine to fine-textured subsoil, a medium water intake rate, and a medium water-holding capacity. The dominant slopes range from six to eight percent.

Crop yields on evaluation area D will be slightly higher than those on evaluation area C.

Evaluation Area E - These lands are located in small isolated tracts along the lower Smith Fork River and those lands in the northeast portion of the project above the Needle Rock ditch. They receive irrigation water from diversions on the Smith Fork River and from Coal Creek. Present water supplies for the lower Smith Fork lands will not be materially changed with construction of the project. However, those lands located in the Coal Creek portion of this evaluation area will receive some additional water under project operations. This additional water will not completely meet the irrigation requirements for these lands but will result in a measurable improvement in water supply and in increased yields.

Lands vary in elevation; the lowest lying lands are those isolated tracts along the lower Smith Fork, and the highest are those lands in the Coal Creek area.

Soils are generally deep with medium-textured surfaces and medium to fine-textured subsoils and are underlain by gravel or cobble. They have medium water intake rates, medium to high water-holding capacities and a dominant slope of six percent.

The evaluation areas as described will serve as the basis for the remainder of the report. Soils, crop production, land development costs, water requirements, economic analyses and other aspects of the reappraisal of direct agricultural benefits will be discussed in terms of these evaluation areas.

Soil Inventory

Source of Data

Basic soil survey information was obtained from a standard soil survey completed by the Soil Conservation Service in August 1957. Laboratory data for soil characterization on eight major project soils was supplied by the Soil Conservation Service. The Colorado Agricultural Experiment Station furnished soil moisture data on these same soils. Additional soil information was obtained in exchange of laboratory data with the Bureau of Reclamation.

Project boundaries were transferred from the Bureau of Reclamation land classification maps to the Soil Conservation Service soil survey field sheets. The acreage within these boundaries was then tabulated by soil survey mapping units.

General Description of Soils

Soils of this project are best grouped on the basis of origin. Areas east and northeast of Crawford and land in the northern part of the project include medium-textured soils, greater than 20 inches deep to gravel or cobble, which have developed from reworked glacial material. Moderately fine and fine-textured soils, greater than 20 inches deep which have developed in place from Mancos shale origin, are found north of Grandview Mesa on the north side of Allen Gulch, north of the town of Crawford along Cottonwood Creek and east of the Crawford Reservoir site.

West of Crawford on the gentle to moderately steep slopes along Grandview Mesa are light and medium-textured soils greater than 20 inches deep which have developed in place from interbedded sandstone and shale.

Along the Smith Fork are medium-textured soils of varying depths to gravel and cobble which have developed from mixed general alluvium.

Soil Problems

General soil problems on this project are: Susceptibility to erosion, moderately deep soils with undulating topography, low fertility and a possible saline condition.

Past erosion has been severe in the Cottonwood Creek area and on Grandview Mesa. However, the present hay and pasture use of soils in these sections and anticipated future hay and small grain rotation, or pasture, should keep soil erosion to a minimum.

The combination of moderately deep soils, moderate to moderately steep slopes and undulating topography presents a problem of surface irrigation. These conditions limit the degree of land leveling and anticipated irrigation efficiencies with the project. The difficulty of farming unstable soil under this same set of conditions has contributed to the severe past erosion on Grandview Mesa.

Soils are generally low in fertility and organic matter. The application of nitrogen and phosphorus fertilizers, plus an improved water supply will increase crop yields and, over a long period of time, maintain the organic matter at a slightly higher level.

At present, soils which have developed from Mancos shale do not contain significant amounts of soluable salts. However, these soils could become highly saline if salts dissolved from the underlying shale are moved upward through the soil.

Interpretive Groupings of Soil Characteristics

The U.S. Department of Agriculture maps the basic soil characteristics. These characteristics are used for many types of interpretive groupings. One type is the land capability classification, expressing the intensity of treatment which the land needs to prevent soil deterioration and assure its continued productivity. The lands considered in the survey are shown in this report by land capability units. This intermediate step in the evaluation of a project, enables a quick appraisal of soils and the management required to cultivate them over a long period without deterioration.

The Department of Agriculture also interprets the basic soil facts mapped in the field to make another grouping of project lands into evaluation areas. The soils, climate, water supply and other physical factors in each evaluation area reflect similar crop adaptations, productivity, land development requirements and production costs.

The land capability classification shows the national system and the acreage of project land in each land capability unit. (Table 2)

Land Capability Classification

For classification purposes, soil mapping units are grouped into land capability units which include the class, subclass and unit.

Example: Land capability unit II s 2

II - Represents the land capability class, which is one of eight broad national classes of land.

s - Represents the subclass, which is one of four broad national divisions of the land capability class.

2 - Represents the unit, which is a local division of the subclass identifying a specific land condition.

The land capability class, shown by roman numerals, expresses the severity of the limitation (s) in use. As the class increases numerically, the severity of the limitation (s) also increases. Land capability classes are defined as follows:

Class I - Very good land suitable for cultivation with no limitations in use and suitable for all climatically adapted crops.

Class II - Good land suitable for cultivation having moderate limitations in use but suitable for all climatically adapted crops.

Class III - Moderately good land suitable for cultivation having severe limitations in use and not suitable for all climatically adapted crops.

Class IV - Fairly good land suitable only for occasional cultivation.

Class V to VIII are not suitable for cultivation.

The subclass expresses the general reason for the limitation in use, such as e, erosion; s, soil; w, water; or c, climate. The unit reflects the specific problem (s) requiring treatment.

The total acreage (8,240) of the project is tabulated by land capability units and evaluation areas. Using the acreage listed in table 2, there are 746 acres in land capability class II; 2,837 acres in land capability class III; 4,163 acres in class IV; and 494 acres representing six percent of 8,240 for roads, farmsteads, etc.

Table three shows the distribution of project lands by land capability units and evaluation areas.

Findings

Tabulated soil survey data includes approximately the same lands which the Bureau of Reclamation proposes to include in the project.

Based on a complete soil survey inventory, it is concluded that the 8,240 acres of project land, less six percent (494 acres) for roads, farmsteads, etc., is suitable for cultivation under irrigation.

Table 2. - General soil characteristics by land capability units, Smith Fork project

Land capability units	General soil characteristics								Acres
	Texture	Permeability	Depth	Parent material	Percent slope	Topography	Water table	Stoniness	
IIw1	medium	slow	deep	alluvium from shale	1-3	smooth	shallow		1
IIe	moderately fine to medium	slow to moderate	moderately deep and deep	mixed alluvium & glacial material	1-3	smooth	---	---	598
IIe1	medium	slow	deep	mixed alluvium	1-3	undulating	---	---	67
IIe2	medium	slow	deep	mixed alluvium	1-3	smooth	---	moderate	80
IIIs	moderately fine to medium	slow to moderate	shallow to deep	mixed alluvium sandstone and shale	1-3	smooth	---	---	228
IIIs1	medium	moderate	shallow & deep	mixed alluvium sandstone & shale	1-3	smooth	---	---	---
IIIs2	medium	moderate to rapid	shallow & moderately deep	mixed alluvium	1-3	smooth	---	moderate	23
IIIe	medium	slow to moderate	moderately deep & deep to shale	mixed alluvium & shale	4-6	smooth	---	---	2,129
IIIe2	medium	slow to moderate	moderately deep to deep	mixed alluvium	4-6	smooth	---	moderate	414
IIIe3	medium	slow	deep	mixed alluvium	4-6	smooth	shallow	---	4
IVs	moderately fine to medium	slow to moderate	shallow to deep	mixed alluvium & shale	1-6	smooth	---	---	2,214

Table 2. - General soil characteristics by land capability units, Smith Fork project, cont.

Land capability units	General soil characteristics								Acres
	Texture	Permeability	Depth	Parent material	Percent slope	Topography	Water table	Stoniness	
IVs1	medium	slow	deep	shale	4-6	undulating	---	---	25
IVs2	medium	slow	shallow	mixed alluvium	4-6	smooth	---	moderate	18
IVs3	medium	moderate	shallow	mixed alluvium	4-6	undulating	---	moderate	5
IVe	moderately fine to medium	slow to moderate	shallow to deep	mixed alluvium shale & sandstone	7-12	---	---	---	1,891
IVe2	medium	slow	shallow to moderately deep	mixed alluvium	7-12	---	---	moderate to very stony	10
Farmstead, (right-of-way and miscellaneous)									494
Total									8,240

Table 3. - Acreage of land capability units by evaluation areas, Smith Fork project

Land capability units	Evaluation areas A Acres	B Acres	C Acres	D Acres	E Acres	Total acres
IIw1	--	--	--	--	1	1
IIe	168	351	--	--	79	598
IIe1	40	27	--	--	--	67
IIIe2	5	75	--	--	--	80
IIIs	25	114	--	12	77	228
IIIs1	4	35	--	--	--	39
IIIs2	23	--	--	--	--	23
IIIe	717	1,127	--	38	247	2,129
IIIe2	273	60	--	--	81	414
IIIe3	---	---	--	--	4	4
IVs	41	311	1,621	211	30	2,214
IVs1	---	---	25	--	--	25
IVs2	---	---	18	--	--	18
IVs3	---	---	5	--	--	5
IVe	393	---	1,166	247	85	1,891
IVe2	---	---	--	--	10	10
Miscellaneous (farmstead, roads, etc.)	107	134	182	32	39	494
Total acres	1,796	2,234	3,017	540	653	8,240

Irrigation Supplies and Requirements

Sources of Data

No detailed studies have been made of irrigation requirements on the Smith Fork project. However, several comprehensive studies include estimates of irrigation requirements in the general vicinity of this project. Among these studies are: (1) Appendix B of the Record of the Upper Colorado River Basin Compact Commission; (2) Consumptive Use and Irrigation Water Requirements of Crops in Colorado, by Harry F. Blaney and Wayne D. Criddle; and (3) Consumptive Use of Water in the Irrigated Areas of the Upper Colorado River Basin, by Blaney and Criddle. Additional related information is contained in the Water Supply Papers of the U.S. Geological Survey, Climatological Data by the U.S. Weather Bureau, Colorado Heat and Moisture Indexes for use in Land Capability Classification by the Soil Conservation Service, and other publications. These and all other available related reports were carefully reviewed for the purpose of this study. In addition, information was supplied by technicians of the Agricultural Research Service, Colorado State University, U.S. Bureau of Reclamation, and others familiar with the area.

Analysis of Data

Consumptive use requirements for the principal crops in the area were estimated by the Blaney-Criddle procedures. Based on projected crop acreage distribution, the average seasonal consumptive use and farm water supply requirements for the project were estimated. (Table 4)

The water supply for the Smith Fork project comes principally from the flow of the Smith Fork River. Historically, the flow of this river varies widely with the seasons. The water supply is quite large during the spring snowmelt period which usually extends through May and part of June. During this period there is usually more water available than can be used, and the excess flows downstream past the project. Later in the summer when crop water requirements are higher, the stream flow diminishes to an amount that is insufficient to meet crop needs on lands that are presently irrigated, with a consequent reduction in crop yields. The water supply shortages thus actually occur during the critical crop months of July, August, and September. These shortages have ranged from about 24 percent to 70 percent, averaging approximately 45 percent of crop needs during these months. As shown in table 4, the shortages will be reduced under project operating condition to an average of four percent of seasonal requirements.

With the installation of the project works, consisting primarily of the Crawford Reservoir and the enlarged and extended Aspen Canal, storage capacity will be provided to meet late-season water demands for the presently irrigated lands. Additional water will be available to meet the requirements of nonirrigated lands proposed for irrigation under the project plan. The availability of adequate late-season water will permit better seasonal distribution than has been possible by direct diversion of unregulated stream flows.

ter requirement estimates by evaluation areas, Smith Fork project 1/

on Area C		Evaluation Area D		Evaluation Area E 2/		Project Total 2/ 3/	
Consumptive use requirements	Crop distribution	Consumptive use requirements	Crop distribution	Consumptive use requirements		Consumptive use requirements	
Ac. ins. per acre	Percent	Ac. ins. per acre	Percent	Ac. ins. per acre			
----	--	----	19	24.1			
23.0	26	23.0	11	22.6			
20.9	42	20.9	32	20.5			
14.8	6	14.8	8	14.6			
11.9	26	11.9	30	11.7			
18.9	--	18.7	--	18.3			18.7
----	35	----	--	----			
33.6	--	34.7	49	19.0		42	25.7
52.5	--	53.4	--	37.3			44.4
4.38	--	4.45	--	3.11			3.70
ation areas B, C & D							
18.8 ins.; Efficiency 40%							
3.90 ac. ft. per acre				2.42			3.55
3.78							
97				78			96

ent full water supply

Table 4. - Projected crop distribution and seasonal consumptive use and water requirement estimates by evaluation areas, Smith Fork project 1/

	Evaluation Area A		Evaluation Area B		Evaluation Area C		Evaluation Area D		Evaluation Area E 2/		Project Total 2/ 3/	
	Crop distribution	Consumptive use requirements	Crop distribution	Consumptive use requirements	Crop distribution	Consumptive use requirements	Crop distribution	Consumptive use requirements	Crop distribution	Consumptive use requirements		Consumptive use requirements
	Percent	Ac. ins. per acre	Percent	Ac. ins. per acre	Percent	Ac. ins. per acre	Percent	Ac. ins. per acre	Percent	Ac. ins. per acre		
Alfalfa	19	24.1	19	24.6	--	----	--	----	19	24.1		
Alfalfa-grass hay	11	22.6	11	23.2	33	23.0	26	23.0	11	22.6		
Rotation pasture	32	20.5	32	21.1	35	20.9	42	20.9	32	20.5		
Corn	8	14.6	13	14.9	6	14.8	6	14.8	8	14.6		
Small Grain	30	11.7	25	12.0	26	11.9	26	11.9	30	11.7		
Weighted Average	--	18.3	--	18.8	--	18.9	--	18.7	--	18.3		18.7
Estimated farm irrigation efficiency percent	49	----	50	----	36	----	35	----	--	----		
Estimated farm losses	--	19.0	--	18.8	--	33.6	--	34.7	49	19.0	42	25.7
Total water requirements at farm headgate												
Ac. ins. per acre	--	37.3	--	37.6	--	52.5	--	53.4	--	37.3		44.4
Ac. ft. per acre	--	3.11	--	3.13	--	4.38	--	4.45	--	3.11		3.70
Average farm headgate water delivery under project operations			Weighted average of evaluation areas B, C & D Consumptive use requirement 18.8 ins.; Efficiency 40% Farm delivery requirement 3.90 ac. ft. per acre							2.42		3.55
Ac. ft. per acre		3.08				3.78						
Percent of water requirements which will be met by average project delivery		99				97				78		96

1/ All percentages rounded

2/ Excluding lower Smith Fork River area which will have no change in present full water supply

3/ Weighted

Farmers now overirrigate during the early months of the irrigation season when surplus water is available, in an effort to minimize, as much as possible, the effects of the late-season difficiencies. Distribution of water in accordance with crop needs will enable farmers to reduce or eliminate this excessive spring irrigation. The result will be increased crop yields with little more total stream depletion than at present.

During years of critically low runoff, excess spring snowmelt has escaped downstream but after project construction this excess water will be stored in the reservoir. Storage will result in a substantial increase in the available supply for the project for those years. The resulting water supply in such years will be approximately equal to that which has existed in the average or better than average years without the project.

The planned capacity of Crawford Reservoir is only slightly in excess of the average project requirements for late-season water. For the normal range of operating conditions, the carry-over will vary from nothing to about 4,000 acre feet.

A project operations study has been made by the Bureau of Reclamation. Review of this study shows that under project operations, with conditions of weather and runoff similar to those of the study period of 1942 to 1956 (including the lowest runoff in the history of the project area), only three years out of 15 would have a less than adequate water supply. Runoff records for the Smith Fork River are of short duration. Comparing these records with nearby longer period records indicates that, if the project had operated during the 58-year period of 1904 to 1957, there would have been only six years with water supplies so short as to adversely affect the project.

Since the reservoir capacity is limited to annual storage and will not provide regulation of runoff from one year to another, it will be important that farm operators within the project have available each year some forecast of the prospective supplies. Such water supply forecasts are usually available from the Soil Conservation Service Snow Survey and Water Supply Forecast program. They make it possible for the farmer to adjust his operations to fit the prospective water supply, thus minimizing the economic effects of a defficient supply.

There are no snow courses on the Smith Fork watershed at present. It would appear that in order to provide an adequate basis for estimating snow cover and forecasting water supplies, existing networks should be extended to provide two or three snow courses on the watershed, with corresponding soil moisture measuring stations.

Findings

Based on a weighted average seasonal consumptive use of 18.7 inches per acre and an estimated on-farm irrigation efficiency of 42 percent, the estimated farm irrigation requirement per irrigated acre is 44.4 inches of water. Proposed project facilities will deliver an average of 42.6 inches of irrigation water at the farm headgate, thus meeting 96 percent of the average requirements of the project lands.

Land and Irrigation Development

Sources of Data

There has been little land development within the project area in recent years. Chronically short water supplies resulting in low yields and small economic returns have provided little incentive for the expenditure necessary to improve and further develop project lands. Consequently, there are no data available relating directly to development costs on the project lands. All estimates have been based on requirements of similar soils in other areas that are somewhat comparable in site conditions but with better water supplies. Cost estimates are based on the U.S. Department of Agriculture price projections of September 1957.

Analysis of Data

Soil and site factors and climatic limitations restrict the amount of development that is physically or economically feasible on project lands. The steep slopes and shallow soils that are characteristic of the area restrict crops to those which provide a permanent cover except on the most erosion-resistant lands. The same factors result in the lower irrigation efficiencies that can be attained with the labor inputs associated with the expected levels of management.

The projected level of development under project conditions is rather low, generally, and is based both on the level of management expected in the area, and on the physical requirements of the soils. Irrigation efficiency estimates reflect this level of development and management. They are higher than exist under present conditions on the project lands, but are readily attainable with the projected additional inputs of labor and the altered patterns of water delivery that will accompany project construction.

Land Clearing

Native cover varies quite widely with elevation and location on the project. It ranges from pinon-juniper type on the higher fringes of evaluation area A, to a sparse growth of low sagebrush and associated brushy plants on Grandview Mesa that are included in evaluation areas C and D. Clearing costs have been estimated largely in relation to the predominate cover existing on lands within the various evaluation areas, and in accord with costs incurred in similar areas of southwestern Colorado.

Land Leveling

Land leveling is defined as "the reshaping of the land surface to a planned grade to permit the uniform distribution of irrigation water without erosion, or to provide necessary surface drainage." This does not imply the removal of slope or gradient from the land surface but, rather, the elimination of surface irregularities which impair the uniform application of irrigation water, or occasionally, the terracing of the land to permit irrigation on flatter, transverse slopes.

There are wide variations in the amount of leveling required for the different soil conditions that prevail within the project. Considerable areas of project lands are unsuited for any but the most limited of leveling operations. Where leveling is restricted to smoothing of the ground surface to remove minor irregularities, such as might be accomplished by farm equipment, it has been estimated as an operating cost rather than as a development cost. In making the analysis for these locations, increased labor inputs and lowered irrigation efficiencies have been used. The lower yields associated with this level of development are also reflected in the analysis.

Farm Irrigation Systems

Existing farm ditches are generally stabilized by vegetation or by plating with gravel and rock. Those on steeper slopes or in more erosive soils are usually plated. In some areas ditches have eroded down to the underlying sandstone or shale. Banks are generally well stabilized by the gravelly soils and by plant growth. Little improvement of existing ditches is expected, particularly in connection with hay and pasture crops. Other than routine replacement of existing control gates and dividers, there probably will be only limited installation of irrigation structures.

Disposal of irrigation waste water is a significant item. In areas where deep, shale-derived soils predominate, the erosion of gully channels by waste water has been, or can become, a serious farm management problem. Cost estimates for farm irrigation systems on nonirrigated lands include an allowance for waste water disposal structures. The weighted average estimate for additional development of existing farm irrigation systems is adequate to cover what few additional on-farm structures may be required for this purpose.

Drainage

A considerable area of land now irrigated but wet or seeped, or presently recognized as susceptible to damage from this cause, has been excluded from the project. Some project lands temporarily have shallow water tables after irrigation. These lands have steep gradients and permeable soils, and natural drainage is effective. No cost estimate has been made for on-farm drainage.

Findings

Only limited amounts of additional development can be accomplished on most project lands. Levels of projected development have been related to physical requirements of the soils as they will be handled under project conditions, and to the economic capabilities of the project. Weighted average development cost estimates are summarized by evaluation areas in table 5.

Table 5. - Weighted average development costs per acre, by evaluation areas, Smith Fork project

	Clearing	Leveling	Farm irrigation system	Total development
			Dollars	
Evaluation area A				
Nonirrigated land	7.12	26.06	25.39	58.57
Presently irrigated land	-----	16.55	2.00	18.55
Evaluation area B				
Nonirrigated land	10.00	25.00	18.00	53.00
Presently irrigated land	-----	20.88	2.00	22.88
Evaluation area C				
Nonirrigated land	12.00	20.00	24.00	56.00
Presently irrigated land	-----	7.69	2.00	9.69
Evaluation area D				
Nonirrigated land	6.22	17.44	24.51	48.17
Evaluation area E				
Presently irrigated land	-----	-----	3.00	3.00

Projected Agricultural Economy

Primary objectives of the economic analysis of agricultural potentials of Smith Fork project are: (1) To develop estimates of potential incomes with the proposed irrigation development, and (2) to estimate direct agricultural benefits that can be expected to accrue with development of additional water for irrigation purposes. These long-time projections are based upon important economic and physical assumptions. The more important assumptions include: (1) Projected types and sizes of farms, crops and livestock produced, and production on nonirrigated lands to be brought under irrigation will be smilar to those on presently irrigated land having comparable physical, climatic and economic environments; (2) present trends in farming practices and crop yields will continue to improve under the impetus of technological advancement; (3) increased production will be absorbed by expanding population without marked disturbance in marketing processes or in local market prices; and (4) the long-term relationship of prices paid to prices received are tied to an all-product index of 235 (1910-14=100) for prices received by farmers and an index of 265 for prices and rates paid by farmers, including items used in production, interest, taxes, and wages.

Budgeting of full-time farms is used in developing estimates of both potential incomes and direct agricultural benefits 'with' and 'without' the project. 'With' project budgets are based on conditions expected after the project has been in operation long enough to have achieved normal input and output relationships.

Sources of Data

Numerous economic studies of irrigation development have been relied upon for the economic and physical standards and the procedures used in the analysis. This background information was supplemented by specific information for the Smith Fork project obtained from three major sources: (1) Material furnished by the U. S. Bureau of Reclamation, (2) a survey of farmers located in the project area conducted during 1957 by the U. S. Bureau of Reclamation and the U. S. Department of Agriculture, and (3) information furnished by local representatives of federal and state agencies, local businessmen, and Colorado State University personnel.

Commodity Price Projections

Prices used for evaluating potential incomes, direct benefits, and associated costs are based upon price and cost projections developed by the U. S. Department of Agriculture. These projections were published in September 1957 for official use by Department of Agriculture agencies in benefit-cost analysis. The projected prices are based upon "relatively high employment, a trend toward peace, continued population and economic growth, and a stable general price level."

The long-term projected index of prices received for all farm commodities is 235, base period 1910-14. A comparable index for prices paid, including interest, wages and taxes, is 265.

Information obtained during the field survey showed that, historically, prices received locally for agricultural commodities have varied from Colorado State average prices and United States average prices. These variations are more pronounced for hay crops, livestock and livestock products and are due primarily to distance from market, off-farm marketing costs, quality of commodities, and the balance between local livestock and local feed supplies. Adjustments in the projected prices of commodities for the State of Colorado were made to reflect these local market conditions. Projected prices of crops, livestock, and livestock products used in the analysis are shown in table 6.

Table 6.- Long-term projected prices of agricultural commodities, Smith Fork project

Item	Unit	Price 1/
		Dollars
Alfalfa hay, baled	Ton	20.50
Corn silage	Ton	7.50
Other hay, baled	Ton	20.50
Barley	Bushel	1.10
Butterfat (whole milk)	Pound	2/ .98
Calves (beef steers)	Cwt.	20.70
Calves (beef heifers)	Cwt.	18.70
Long yearlings (beef steers)	Cwt.	18.70
Long yearlings (beef heifers)	Cwt.	16.70
Cull cows (beef)	Cwt.	12.50
Cull cows (dairy)	Cwt.	10.00
Lambs	Cwt.	19.00
Cull ewes	Cwt.	6.00
Wool	Pound	.49

1/ Net prices received by farmers.
2/ Weighted average, 37.5 percent grade-A and 62.5 percent grade-C whole milk at 3.5 test.

Based upon price projections by the U. S. Department of Agriculture, September 1957.

Projected Crop Yields

Eight basic projected crop yield levels are used (table 7). These levels represent future production rates 'with' and 'without' the project for evaluation areas A, B, C, D, and E. Projected crop yields are based upon secondary data relating to crop yields in the general area, farmers estimates of crop yields for the years 1956 and 1957, and their estimates of probable yields 'with' the project obtained during the field survey. In addition, the experience and judgement of extension and research workers in agronomy, soils, irrigation, and economics were drawn upon in estimating future yields. In making these estimates it was assumed that there would be a general improvement in farming practices, particularly in the adoption of better crop rotations, improved timing of farm operations, greater use of fertilizer and improvement in the management of water.

Table 7.- Projected crop yields 'with' and 'without' the project, by evaluation areas, 1/ Smith Fork project

Item	Unit	Without project 2/ evaluation areas						With project 3/ evaluation areas					
		A	B	C	D	E	Weighted average	A	B	C	D	E	Weighted average
Weighting	Percent	23.0	29.0	39.0	---	9.0	100.0	22.0	27.0	37.0	6.0	8.0	100.0
Alfalfa	Ton	2.5	2.4	2.1	---	2.5	2.3	3.3	3.4	3.0	3.1	2.8	3.2
Other hay	Ton	1.8	1.5	1.3	---	1.8	1.5	2.5	2.3	2.0	2.1	2.1	2.2
Rotation pasture	AUM	4.0	4.0	3.5	---	4.0	3.8	6.0	6.0	5.5	5.6	4.6	5.7
Corn silage	Ton	9.0	10.0	8.0	---	9.0	8.9	12.0	13.0	11.0	11.5	10.0	11.7
Barley	Bushel	50.0	45.0	40.0	---	5.0	44.6	60.0	55.0	50.0	51.0	58.0	54.2
Permanent pasture 4/	AUM	2.0	2.0	1.5	1.5	2.0	1.8	2.0	2.0	1.5	1.5	2.0	1.8

1/ Two hundred and fifty acres of arable land included in evaluation area E are projected to receive essentially the same supply of water 'with' and 'without' the project.
2/ Fertilizer: Sufficient manure produced on farms to maintain projected yields.
3/ Fertilizer: Annual rate; alfalfa, 30 pounds available P_2O_5 or equivalent manure per acre; rotation pasture, 20 pounds P_2O_5 and 20 pounds N; barley, following corn or barley, 20 pounds N. Total P_2O_5 required applied at time of seeding. Nitrogen applied annually.
4/ Projected to receive essentially the same supply of water 'with' and 'without' the project.

Livestock Enterprises and Production Rates

Present income of the area is derived primarily from the sale of livestock and livestock products. Breeding beef herds predominate, followed by dairy herds and sheep. Project farmers hold grazing permits on the Gunnison National Forest and adjacent lands administered by the Bureau of Land Management for approximately 2,000 head of cattle and 5,200 head of sheep.

Project development is not expected to affect any basic change in the livestock economy of the area. It will, however, result in an increase in feed crops and pasture available for livestock. The increased feed supply is likely to result in an increase in the number of dairy cows, farm sheep, and feeder steers.

Livestock turnoff rates are shown in table 8. They include production of 300 pounds of butterfat per dairy cow, 460 pounds of grass-fat long yearlings per beef cow, 92 pounds of grass fat lamb, and 10 pounds of wool per ewe.

Table 8.- Estimated turnoff rates per 100 head of breeding livestock, Smith Fork project

Livestock	Beginning inventory	Born	Died	Annual turnoff Number	Weight	Total	Ending inventory
					-- Lbs. --		
Dairy:							
Cows (2 yrs. and over)	100	--	3	22	1,200	26,400	100
Heifers (1 yr. and over)	26	--	1	--	--	--	26
Heifers (under 1 yr.)	28	--	2	--	--	--	28
Calves	--	90	5	1/57	--	--	--
Butterfat (3.5 test)	--	--	-	100	300	30,000	--
Beef:							
Cows	100	--	3	16	1,000	16,000	100
Replacements 2/	19	--	-	--	--	--	19
Long yearlings 3/	82	--	3	60	768	46,080	82
Calves	--	85	3	--	--	--	--
Bulls	4	--	-	--	--	--	4
Feeder steers	100	4/100	2	98	785	76,930	100
Sheep:							
Ewes	100	4/100	10	90	125	11,250	100
Lambs	--	5/110	7	103	90	9,270	--
Rams	3	--	-	--	--	--	3
Wool	--	--	-	103	10	1,030	--

1/ Nonreplacement calves will be sold soon after birth.
2/ Heifers will be bred to calve at 3 years.
3/ Nonreplacement long yearlings sold as grass-fats.
4/ Purchased.
5/ Number at docking time.

Types and Sizes of Farms

Projected types of farms with project development are based upon future markets for each agricultural commodity, existing types of farms on the project, available federal grazing permits, and opinions of local agricultural leaders. At present, beef farms predominate, constituting 46 percent of all full-time farms surveyed followed by: Dairy, 23 percent; general, 20 percent; and sheep, 11 percent. The beef and sheep farms are operated in conjunction with federal grazing permits. The dairy farms utilize most of the forage crops produced on the farm and sell some grain. The general farms have a small number of livestock--dairy, beef, or sheep-- and sell a majority of the hay and grain produced.

Development of the project is not expected to result in an increase in either the number of beef or sheep farms with range permits, or the number of livestock in the breeding herds on these farms. Federal grazing permits are now fully utilized and are not expected to increase.

Present size of farm operating units are somewhat larger than normally encountered in irrigated areas. The irrigated acreage per farm averaged 190 acres for beef and sheep farms, 154 acres for general farms, and 126 acres for dairy farms.

There are 1,320 acres of arable nonirrigated land in evaluation areas A, B, C, and D which is suitable for irrigation. Of this area 780 acres lie in small scattered tracts on existing farms and are likely to be developed in conjunction with land already under cultivation. This will result in an increase in the irrigated acreage per farm. Other adjustments in acreage of existing farms are not anticipated. The 540 acres of arable nonirrigated land in evaluation area D lie in fairly contiguous tracts. This area provides the greatest opportunity for the establishment of new farms and adjustment in size of farm.

A brief description of each projected farm type follows:

Range beef [1/] - Part of the feed supply is furnished by federal range which limits the numbers of breeding cows to twenty 100-cow herds or equivalent. The irrigated land serves as a winter feed base for the breeding herd and provides summer pasturage for short yearlings. Calves are sold in the 'without' project situation and grass-fat long yearlings are sold in the 'with' project situation. In some budgets, additional hay is purchased to supply sufficient feed for wintering the herd. Irrigated acreage per farm averages 210 acres 2/ and utilizes 52 percent of the total arable acreage.

1/ This type is used to represent livestock farms with range permits.

2/ The 'without' project situation consists of 160 acres of arable land of which 20 acres are idle, and 50 acres of nonarable land irrigated. In the 'with' project situation the 20 acres of idle land are developed and irrigated.

Dairy - The dairy farm includes modern equipment for the production and sale of high quality whole milk. Number of cows per farm range from 28 to 36. Irrigated acreage per farm averages 145 acres. 1/ This type utilizes 24 percent of the arable land. The farm family would be fully employed.

Feeder steers - Principle return from this type would be from sale of grass-fat long yearlings. Steer calves are purchased in the fall and sold the following fall. All feed is produced on the farm. Irrigated acreage per farm averages 175 acres 2/ and utilizes 15 percent of the arable acreage.

Farm sheep - Income is derived from the sale of grass-fat lambs, old ewes, and wool. Spread-mouth ewes are purchased in the fall. They produce a lamb and wool crop the following spring and summer and are then sold. Irrigated acreage per farm averages 175 acres. 3/ This type accounts for 9 percent of the arable acreage.

Anticipated Cropping Systems and Management Practices

Climatic conditions, topography, and distance to central markets are the limiting factors to the type of crops that can be commercially produced in the project area. As a result, over 82 percent of the irrigated area is presently devoted to the production of hay and pasture, 13 percent is devoted to the production of small grains, 3 percent to silage corn, and 2 percent to miscellaneous crops. The area is well adapted to the production of small grains. Yields of small grains exceed and yields of hay compare favorably with yields obtained in similar irrigated areas. Due to a shortage of late-season irrigation water and a short growing season, production of alfalfa has been limited to two cuttings. Silage corn is occasionally damaged by frost.

Soil management and crop rotation have been handicapped by irregularity of water delivery and extreme shortage during the later half of the growing season. Alfalfa, grass hay, and pasture have been retained for more years

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1/ Consists of 125 acres of arable land and 20 acres of nonarable land irrigated. In the 'without' project situation, evaluation areas A, B, and D, 10 acres of the arable land is idle. In the 'with' project situation the 10 acres of idle land are developed and irrigated.

2/ Consists of 140 acres of arable land and 35 acres of nonarable land irrigated. In the 'without' project situation, evaluation areas A, B, and C, 10 acres of the arable land is idle. In the 'with' project situation the 10 acres of idle land are developed and irrigated. The 'with' project situation, evaluation area D, consists of 160 acres of arable land and 40 acres of nonarable land irrigated.

3/ ibid.

than is consistent with good production. Shortage of water in July and August makes the establishment of stands hazardous. The young plants frequently drouth out during July and August. Consequently, farmers have been reluctant to plow hay and pasture land as long as fair yields are obtained.

The soils in the area respond well to fall plowing. When fall plowed, they mellow over the winter and can be easily worked into a desirable seedbed and planted early the following spring. The young plants utilize winter soil mositure more effectively and begin growth one to two weeks earlier than when the land is plowed in the spring. This practice has been frequently handicapped or prevented by lack of water during the latter part of the growing season. The soils dry out and become so hard that fall plowing becomes impractical.

Fertilizer use has consisted primarily of barnyard manure. Commercial fertilizers have been used sparingly. With a supplemental water supply, increased use of commercial fertilizer can be expected. Response from phosphate on alfalfa, and nitrogen on pasture and meadow hay in similar areas with adequate water supplies has been substantial.

A surplus of irrigation water during May and June and a shortage during July and August has resulted in poor irrigation from the standpoint of plant needs. The oft expressed goal of farmers is to have all fields wet when the water supply fails, usually about July 1. This results in over-irrigation during the forepart of the growing season and underirrigation during the latter part. Both are detrimental to optimum plant growth. Farmers are generally aware that they overirrigate during the forepart of the season, but feel this to be more desirable than being caught with dry fields and no water. During a specific crop year the exact date the water supply will fail is unknown. Development of the project is expected to result in an overall improvement in cultural practices.

Development of the project is not expected to affect the type of crops produced. Supplemental irrigation water will, however, increase the reliability of crop production and allow farmers greater freedom in adjusting acreages of crops to obtain balanced feed supplies for livestock. It is anticipated that grass hay will continue to be produced on the lower lying lands and to some extent on the steeper lands which are subject to erosion. Grasses readily invade alfalfa stands and on the lower lying lands, soil moisture conditions are more favorable for grasses than alfalfa. With a late-season water supply three cuttings of alfalfa will be possible in the lower portion of the project area. The projected crop distribution by evaluation areas is shown in table 9.

Table 9.- Projected cropping pattern, 'with' and 'without' project, by evaluation areas, Smith Fork project

Crop / Evaluation areas	Without project						With project					
	A	B	C	D	E	Total	A	B	C	D	E	Total
	Acres											
Alfalfa	488	531	543	-	170	1,732	329	394	468	68	107	1,366
Grass hay	168	191	543	-	65	967	180	223	461	64	65	993
Rotation pasture	320	389	621	-	144	1,474	533	679	1,001	214	207	2,634
Corn silage	135	230	160	-	52	577	144	268	181	32	52	677
Barley	472	460	640	-	183	1,755	503	536	724	130	183	2,076
Nonirrigated	112	318	350	540	-	1,320	-	-	-	-	-	-
Farmstead	101	115	160	-	39	415	107	134	182	32	39	494
Total	1,796	2,234	3,017	540	653	8,240	1,796	2,234	3,017	540	653	8,240
Permanent pasture	533	578	822	144	79	2,156	533	578	822	144	79	2,156

Returns to Operator and Family Labor and Management

An appraisal of the adequacy of projected farm incomes requires a guide or standard in terms of return to operator and family management and labor. For purposes of this report, a return of $3,100 is used as a minimum average for full-time farms. 1/ Variations from this amount would be expected with different managerial requirements, quantities of operator and family labor and, in established farming areas, the willingness of farm families to accept lower returns rather than move to alternative employment.

1/ Fuhriman, W.U., Blanch, G.T., and Stewart, C.E. An Economic Analysis of the Agricultural Potentials of the Weber Basin Reclamation Project, Utah. Utah Agricultural Experiment Station Special Report No. 7, December 1952.
U. S. Department of Agriculture and U. S. Department of Commerce, Farmers Expenditures, a special cooperative survey, December 1956.

This analysis is oriented to estimate potential farm incomes with development of the project. The $3,100 serves as a reference point in comparing potential incomes in the project area. The $3,100 should not be misconstrued to represent the total net return to the farm family from operation of the farm business.

In addition to return for management and labor, the farm family would have a return on its equity in the farm. Assuming that, on the Smith Fork project, farmers equities 1/ in physical assets would compare favorably with the current national average, return on equity in physical assets would average about $2,025. Return on equity plus return on family labor and management or a total of about $5,125 would be available to the farm family for living expenses, including income and social security taxes, savings, and retirement of debts.

In estimating direct agricultural benefits, the $3,100 serves as a basis for estimating the hourly rate of return to labor and management. The opportunity-cost approach is used which evaluates farm family labor and management in the same manner as other resources. Since management and family labor are not priced in the market as are most factors of production, establishment of a price for this resource is necessary. The additional labor required in the 'with' project situation is recognized in the analysis.

Local inquiries have been made in connection with the Upper Colorado River Basin survey. Expenditures for family living have been obtained from records of the Farmers Home Administration. Reports on special studies have also been utilized. A general observation is that the standard set forth for the Smith Fork project in terms of funds available for family living, is greater than average current expenditures by farm families in the vicinity of the Smith Fork project. This is to be expected since projections for the Smith Fork project are oriented to an improved agricultural economy.

The labor standard used in the projected budgets is a maximum of 3,000 hours labor for the operator and 1,500 hours for the family with a maximum in any one month of 420 hours total. Variations in the actual amount of labor required occur on the projected farms because of differences in types and sizes.

Projected Agricultural Incomes and Direct Benefits

Typical farm budgets are used to estimate potential incomes and direct agricultural benefits. Typical farms were set up and incomes derived on the basis of projected prices and other assumptions. These incomes for individual farms are then weighted on the basis of total acreages in each type to obtain an estimate for the average income expected with development of the proposed Smith Fork project. The potential income budgets also serve as the basic framework for estimating direct agricultural benefits.

1/ U. S. Department of Agriculture, Agricultural Research Service 43-42, Agricultural Finance Outlook, November 1956. (Average equity 86 percent)

Budgeting of typical farms requires many kinds of input-output and price information. Labor requirements, machinery and building needs, land investment, feed requirements, and other data are needed. Research in similar irrigated areas has been heavily relied upon for this information. It has been supplemented by information obtained during the field survey. Prices and expenses were also obtained in the Smith Fork area.

The terms farm income and adjusted farm income are used in the following discussion. For purposes of this report these terms are defined as follows:

> Farm income - Total farm receipts less total farm expenses except; (1) interest on capital investment, (2) irrigation water costs and (3) allowance for operator and family labor and management.
>
> Adjusted farm income - Farm income less interest on capital investment except interest on investment in land and water.

Projected Agricultural Income

Estimates of potential farm incomes have been made for typical range beef, dairy, feeder steer, and farm sheep farms. Salient features of the four basic types were described in preceeding sections. Farm budgets for each type were developed for evaluation areas A, B, and C.

The feeder steer type farm, only, was used in estimating potential farm incomes for evaluation area D. While this area provides the greatest opportunity for the development of new farms, the acreage is relatively small. Operators of newly established farms are not likely to hold federal grazing permits and the area's location is likely to discourage the establishment of dairy farms. Feeder steer and farm sheep type farms are the most likely to develop on area D. Since farm incomes are similar for feeder steer and farm sheep type farms, the feeder steer budget was used in estimating potential farm incomes for evaluation area D. Dairy and feeder steer type farm budgets were used for area E.

The summaries of selected items from projected farm budgets give a general indication of sizes and organization of the four basic types of farms considered, tables 10, 10A, 10B, and 10C. With project development the weighted average farm receipts for evaluation areas A, B, C, D, and E are $14,416, $14,263, $13,130, $20,182, and $13,636, respectively. Correspondingly, annual farm expenses, excluding interest and water costs, average $8,199, $8,259, $8,158, $15,034, and $8,933 per farm. These result in average farm incomes of $6,217, $6,004, $4,972, $5,148, and $4,703. Interest on investment, except investment in land and irrigation water, at five percent amounts to $1,581, $1,610, $1,541, $1,088, and $1,078. If these interest amounts are deducted from farm incomes, the weighted average adjusted farm incomes 1/ would be $4,636, $4,394, $3,431, $4,060, and $3,625, respectively.

1/ Return to operator and family labor and management and to land and irrigation water.

Table 10.- Projected agricultural incomes and selected sizes and organizational items for farm budgets, evaluation area A, Smith Fork project

Item	Unit	With project				
Farm type		Range beef	Dairy	Feeder steers	Farm sheep	Weighted average
Weighting	Percent	56	26	11	7	100.0
Total land	Acres	210	145	175	175	187
Forage	Acres	92	73	82	82	85
Corn silage	Acres	13	10	11	11	12
Barley	Acres	45	35	39	39	41
Idle	Acres	--	--	--	--	--
Farmstead	Acres	10	7	8	8	9
Permanent pasture	Acres	50	20	35	35	40
Productive livestock	Number	100	33	116	338	--
Total man labor	Hours	3,428	5,007	2,171	2,789	3,649
Operator & family	Hours	3,308	4,500	2,069	2,687	3,432
Total tractor use	Hours	910	754	724	741	837
Farm tractor	Hours	816	682	644	661	751
Total investment	Dollars	38,492	25,768	21,016	15,124	31,628
Bldg., & improvement	Dollars	3,405	5,633	3,247	4,110	4,010
Machinery	Dollars	6,746	8,706	6,746	6,806	7,256
Livestock	Dollars	27,250	10,250	10,206	3,215	19,286
Other	Dollars	1,091	1,179	817	993	1,076
Total receipts	Dollars	14,446	12,445	19,587	12,981	14,416
Crop sales	Dollars	2,836	1,679	2,458	2,069	2,442
Livestock & prod.	Dollars	11,510	10,568	17,029	10,812	11,849
Other	Dollars	100	198	100	100	125
Total farm expenses 1/	Dollars	7,985	5,953	14,445	8,008	8,199
Farm income	Dollars	6,461	6,492	5,142	4,973	6,217
Interest 2/	Dollars	1,925	1,288	1,051	756	1,581
Adjusted farm income 3/	Dollars	4,536	5,204	4,091	4,217	4,636

1/ Excluding interest and annual water costs.
2/ At 5 percent.
3/ Return to operator and family labor and management and to land and irrigation water.

Based upon price projections by U. S. Department of Agriculture, September 1957

Table 10A.- Projected agricultural incomes and selected sizes and organizational items for farm budgets, evaluation area B, Smith Fork project

Item / Farm type	Unit	With project				
		Range beef	Dairy	Feeder steers	Farm sheep	Weighted average
Weighting	Percent	56	26	11	7	100.0
Total land	Acres	210	145	175	175	187
Forage	Acres	93	73	81	81	85
Corn silage	Acres	19	15	17	17	18
Barley	Acres	38	30	34	34	35
Idle	Acres	--	--	--	--	--
Farmstead	Acres	10	7	8	8	9
Permanent pasture	Acres	50	20	35	35	40
Productive livestock	Number	100	36	124	361	--
Total man labor	Hours	3,531	5,398	2,226	2,910	3,822
Operator & family	Hours	3,394	4,500	2,103	2,787	3,491
Total tractor use	Hours	968	817	741	775	890
Farm tractor	Hours	871	740	654	688	800
Total investment	Dollars	38,700	27,019	21,895	15,566	32,197
Bldg., & improvement	Dollars	3,555	5,783	3,397	4,260	4,160
Machinery	Dollars	6,746	8,706	6,746	6,806	7,256
Livestock	Dollars	27,250	11,250	10,910	3,444	19,640
Other	Dollars	1,149	1,280	842	1,056	1,141
Total receipts	Dollars	13,800	12,901	20,263	13,192	14,263
Crop sales	Dollars	2,190	1,152	1,960	1,547	1,852
Livestock & prod.	Dollars	11,510	11,551	18,203	11,545	12,286
Other	Dollars	100	198	100	100	125
Total farm expenses 1/	Dollars	7,573	6,594	15,300	8,427	8,259
Farm income	Dollars	6,227	6,307	4,963	4,765	6,004
Interest 2/	Dollars	1,935	1,351	1,095	788	1,610
Adjusted farm income 3/	Dollars	4,292	4,956	3,868	3,987	4,394

1/ Excluding interest and annual water costs.
2/ At 5 percent.
3/ Return to operator and family labor and management and to land and irrigation water.

Based upon price projections by U. S. Department of Agriculture, September 1957

Table 10B.- Projected agricultural incomes and selected sizes and organizational items for farm budgets, evaluation area C, Smith Fork project

Item / Farm type	Unit	With project				
		Range beef	Dairy	Feeder steers	Farm sheep	Weighted average
Weighting	Percent	56	26	11	7	100.0
Total land	Acres	210	145	175	175	187
Forage	Acres	102	80	90	90	94
Corn silage	Acres	10	8	8	8	9
Barley	Acres	38	30	34	34	35
Idle	Acres	--	--	--	--	--
Farmstead	Acres	10	7	8	8	9
Permanent pasture	Acres	50	20	35	35	40
Productive livestock	Number	100	30	104	301	--
Total man labor	Hours	3,599	4,882	2,312	2,862	3,733
Operator and family	Hours	3,469	4,500	2,231	2,763	3,546
Total tractor use	Hours	896	769	726	746	834
Farm tractor	Hours	820	709	660	680	764
Total investment	Dollars	37,969	24,482	19,713	14,521	30,813
Bldg., & improvement	Dollars	3,097	5,483	3,097	3,960	3,771
Machinery	Dollars	6,746	8,706	6,746	6,806	7,256
Livestock	Dollars	27,250	9,250	9,150	2,866	18,884
Other	Dollars	876	1,043	720	889	902
Total receipts	Dollars	13,596	10,864	17,143	11,156	13,130
Crop sales	Dollars	1,986	1,091	1,776	1,431	1,694
Livestock & prod.	Dollars	11,510	9,575	15,267	9,625	11,311
Other	Dollars	100	198	100	100	125
Total farm expenses 1/	Dollars	8,516	5,455	13,045	7,273	8,158
Farm income	Dollars	5,080	5,409	4,098	3,883	4,972
Interest 2/	Dollars	1,898	1,224	986	726	1,541
Adjusted farm income 3/	Dollars	3,182	4,185	3,112	3,157	3,431

1/ Excluding interest and annual water costs.
2/ At 5 percent.
3/ Return to operator and family labor and management and to land and irrigation water.

Based upon price projections by U. S. Department of Agriculture, September 1957

Table 10C.- Projected agricultural incomes and selected sizes and organizational items for farm budgets, evaluation areas D and E, Smith Fork project

Item	Unit	Evaluation area D	Evaluation area E		
		With project	With project		
Farm type		Feeder steers	Dairy	Feeder steers	Weighted average
Weighting	Percent	--	50	50	100.0
Total land	Acres	200	145	175	160
Forage	Acres	102	73	82	78
Corn silage	Acres	10	10	11	10
Barley	Acres	38	35	39	37
Idle	Acres	--	--	--	--
Farmstead	Acres	10	7	8	8
Permanent pasture	Acres	40	20	35	28
Productive livestock	Number	123	28	95	--
Total man labor	Hours	2,641	4,404	1,925	3,200
Operator and family	Hours	2,530	4,270	1,823	3,074
Total tractor use	Hours	827	730	692	711
Farm tractor	Hours	751	659	612	636
Total investment	Dollars	21,769	24,088	19,019	21,554
Bldg., & improvements	Dollars	3,360	5,633	3,247	4,440
Machinery	Dollars	6,746	8,706	6,746	7,726
Livestock	Dollars	10,822	8,750	8,358	8,554
Other	Dollars	841	999	668	834
Total receipts	Dollars	20,182	10,851	16,421	13,636
Crop sales	Dollars	2,026	1,681	2,375	2,028
Livestock & prod.	Dollars	18,056	8,972	13,946	11,459
Other	Dollars	100	198	100	149
Total farm expenses	Dollars	15,034	5,361	12,488	8,933
Farm income	Dollars	5,148	5,490	3,933	4,703
Interest 2/	Dollars	1,088	1,204	951	1,078
Adjusted farm income 3/	Dollars	4,060	4,286	2,982	3,625

1/ Excluding interest and annual water costs.
2/ At 5 percent.
3/ Return to operator and family labor and management and to land and irrigation water.

Based upon price projections by the U. S. Department of Agriculture, September 1957

There is considerable variation in adjusted farm incomes among the types of farms and among evaluation areas. When both farm type and evaluation area are considered, adjusted farm incomes range from $2,982 on the feeder steer farm in evaluation area E to $5,204 on the dairy farm in evaluation area A.

Operator and family labor for all projected farms averaged 3,400 hours per farm. An allocation of $3,100 for operator and family labor and management would result in an average return per hour for labor of 91 cents. The projected rate for hired farm labor is $1.00 per hour.

Findings

Adjusted farm incomes based on the projected budgets with the proposed additional irrigation water would result in an improved agricultural economy on the Smith Fork project. Weighted average adjusted farm incomes per farm are estimated at $4,010. This amount would be available for family living expenses and for payment of land and irrigation water costs.

Direct Agricultural Benefits

A primary objective of the analysis is to estimate direct agricultural benefits. These benefits are defined as the value of farm production expected with project development in excess of farm production anticipated without project development, less the value of additional farm inputs or associated costs required. The assumptions on the specific composition and value of additional farm inputs or associated costs, as used in this report, are outlined below.

A basic assumption is that the national economy will operate at essentially full employment for the period of analysis. Based on this general assumption, alternative employment opportunities would be expected in the national economy for resources used in the development and operation of irrigated farms, including the labor and management skills of farm operators. Also, the projected levels of farm prices received and paid are higher than they would be with a significant amount of unemployment.

Because of relatively fixed and enduring local obstacles to economic adjustments, some under-employment of resources may exist for a relatively long period on Smith Fork project farms without additional water. Partly, this means that some increased employment of local resources may be attributable to additional irrigation water, depending on the present farm size and organization.

The estimates of direct agricultural benefits are made on the basis of the budgets presented in the preceeding section. However, in the evaluation of benefits and associated costs, the costs and returns of livestock enterprises are not included. Incomes and costs associated with the nonarable irrigated land and federal and private rangelands are also eliminated. This approach tends to avoid the problem of making proper cost allowances for the different levels of management and different quantities of operator and family labor required for different types of farms and for associated land used in conjunction with project land.

The cropping patterns assumed in the benefit analysis are the same as used in the analysis of potential farm incomes with the exception of rotation pasture. For ease of computation the acreage of rotation pasture was changed to alfalfa. It is generally assumed that when all costs are considered, net income per acre derived from alfalfa is equal to net income derived from rotation pasture. The cropping patterns used reflect the need for feed crops in livestock enterprises. Also, prices for feed crops are based upon their local value in livestock enterprises.

Farms with an adequate water supply will require considerably more labor, including operator and family labor, than farms with partial water supplies. In the 'with' project budget, the additional operator and family labor required is considered as an expense in deriving benefits. This additional labor has been charged at the rate of $1.00 per hour.

Tables 11, 11A, 11B, 11C, and 11D show the value of crop production, annual production costs, and the difference in incomes by evaluation areas. With project development the weighted average increase in adjusted farm incomes for evaluation areas A, B, C, and E are $2,262, $2,275, $1,844, and $732, respectively. The value of the additional operator and family labor required to obtain the increased production amounts to $482, $484, $489, and $198. Subtraction of these amounts leaves a balance of $1,780, $1,791, $1,355 and $534. These latter amounts are available for the payment of the additional land and farm irrigation system improvements required and for supplemental irrigation water.

Evaluation area D represents the nonirrigated land on which new farm units are most likely to be established. Adjusted farm income for the projected new farms is $3,841. Subtraction of the total value of operator and family labor required in production, $2,093, leaves a balance of $1,748. This amount would be available for payment of land and farm irrigation system development and for a full supply of irrigation water.

Land Investment Associated with the Project

The acreage in each evaluation area, the projected investment 'with' and 'without' the project and the additional cost of land and farm irrigation system improvements required with the project, are shown in table 12. Costs of farm buildings, machinery, fences, domestic water, and maintenance and replacement costs of the farm irrigation system are included as farm expenses in the budgets (tables 10A and 11). Man and machine labor have been aligned with the degree of land and farm irrigation systems development for each evaluation area.

Projected additional investments per irrigated acre required with project development for evaluation areas A, B, C, and E are $19, $23, $10, and $3, respectively. Development costs per irrigable acre (nonirrigated land) included in evaluation areas A, B, C, and D are $59, $53, $56, and $48, respectively. At five percent the annual weighted average costs per acre for the total additional investments required would be; A, $1.15; B, $1.45; C, 70 cents; D, $2,90; and E, 15 cents.

Table 11.- Summary: Weighted average value of production and annual production costs, except land and water, for projected farm budgets on the basis of crop sales only, by evaluation areas, Smith Fork project

Item / Evaluation areas	Unit	Without project				With project				
		A	B	C	E	A	B	C	D	E
Weighting	Percent	23	29	39	9	22	27	37	6	8
Irrigated land	Acres	132	132	132	140	147	147	147	160	140
Irrigable land	Acres	15	15	15	---	---	---	---	---	---
Operator and family labor	Hours	1,432	1,445	1,501	1,518	1,914	1,929	1,990	2,093	1,716
Receipts	Dollars	6,568	6,338	5,147	6,986	9,352	9,452	8,018	9,045	7,895
Expenses 1/	Dollars	3,890	4,028	3,462	3,885	4,381	4,832	4,472	4,658	4,050
Farm income	Dollars	2,678	2,310	1,685	3,101	4,971	4,620	3,546	4,387	3,845
Interest 2/	Dollars	507	510	509	507	538	545	526	546	519
Adjusted farm income	Dollars	2,171	1,800	1,176	2,594	4,433	4,075	3,020	3,841	3,326
Difference	Dollars	---	---	---	---	2,262	2,275	1,844	3,841	732
Cost of extra family labor 3/	Dollars	---	---	---	---	482	484	489	2,093	198
Increased income	Dollars	---	---	---	---	1,780	1,791	1,355	1,748	534
Increased income, per acre	Dollars	---	---	---	---	12.11	12.18	9.22	10.92	3.81

1/ Water costs and interest not included.
2/ At 5 percent, excluding investment in land.
3/ At $1.00 per hour.

Table 11A.- Weighted average value of production and annual production costs, except land and water, for projected farm budgets on the basis of crop sales only, evaluation area A, Smith Fork project

Item / Farm type	Unit	Without project				With project			
		Range beef	Dairy	Feeder steers and sheep	Weighted average	Range beef	Dairy	Feeder steers and sheep	Weighted average
Weighting	Percent	56	26	18	100	56	26	18	100
Irrigated land	Acres	140	115	130	132	160	125	140	147
Irrigable land (idle)	Acres	20	10	10	15	---	---	---	---
Operator and family labor	Hours	1,522	1,251	1,409	1,432	2,072	1,634	1,826	1,914
Receipts	Dollars	6,986	5,741	6,452	6,568	10,134	7,970	8,906	9,352
Expenses 1/	Dollars	4,043	3,679	3,719	3,890	4,610	4,074	4,113	4,381
Farm income	Dollars	2,943	2,062	2,733	2,678	5,524	3,896	4,793	4,971
Interest 2/	Dollars	513	494	504	507	547	521	533	538
Adjusted farm income	Dollars	2,430	1,568	2,229	2,171	4,977	3,375	4,260	4,433
Difference	Dollars	---	---	---	---	2,547	1,807	2,031	2,262
Cost of extra family labor 3/	Dollars	---	---	---	---	550	383	417	482
Increased income, total	Dollars	---	---	---	---	1,997	1,424	1,614	1,780
Increased income, per acre	Dollars	---	---	---	---	12.48	11.39	11.53	12.11

1/ Water costs and interest not included.
2/ At 5 percent, excluding investment in land.
3/ At $1.00 per hour.

Table 11B.- Weighted average value of production and annual production costs, except land and water, for projected farm budgets on the basis of crop sales only, evaluation area B, Smith Fork project

Item	Unit	Without project				With project			
Farm type		Range beef	Dairy	Feeder steers and sheep	Weighted average	Range beef	Dairy	Feeder steers and sheep	Weighted average
Weighting	Percent	56	26	18	100	56	26	18	100
Irrigated land	Acres	140	115	130	132	160	125	140	147
Irrigable land (idle)	Acres	20	10	10	15	---	---	---	---
Operator and family labor	Hours	1,537	1,260	1,422	1,445	2,021	1,760	1,887	1,929
Receipts	Dollars	6,734	5,530	6,264	6,338	10,234	8,063	9,018	9,452
Expenses 1/	Dollars	4,178	3,812	3,871	4,028	5,155	4,350	4,523	4,832
Farm income	Dollars	2,556	1,718	2,393	2,310	5,079	3,713	4,495	4,620
Interest 2/	Dollars	516	498	507	510	555	529	538	545
Adjusted farm income	Dollars	2,040	1,220	1,886	1,800	4,524	3,184	3,957	4,075
Difference	Dollars	---	---	---	---	2,484	1,964	2,071	2,275
Cost of extra family labor 3/	Dollars	---	---	---	---	484	500	465	484
Increased income, total	Dollars	---	---	---	---	2,000	1,464	1,606	1,791
Increased income, per acre	Dollars	---	---	---	---	12.50	11.71	11.47	12.18

1/ Water costs and interest not included.
2/ At 5 percent, excluding investment in land.
3/ At $1.00 per hour.

Table 11C.- Weighted average value of production and annual production costs, except land and water, for projected farm budgets on the basis of crop sales only, evaluation area C, Smith Fork project

Item / Farm type	Unit	Without project				With project			
		Range beef	Dairy	Feeder steers and sheep	Weighted average	Range beef	Dairy	Feeder steers and sheep	Weighted average
Weighting	Percent	56	26	18	100	56	26	18	100
Irrigated land	Acres	140	115	130	132	160	125	140	147
Irrigable land (idle)	Acres	20	10	10	15	---	---	---	---
Operator and family labor	Hours	1,583	1,305	1,526	1,501	2,085	1,808	1,956	1,990
Receipts	Dollars	5,426	4,475	5,241	5,147	8,721	6,719	7,695	8,018
Expenses 1/	Dollars	3,518	3,363	3,432	3,462	4,815	3,930	4,187	4,472
Farm income	Dollars	1,908	1,112	1,809	1,685	3,906	2,789	3,508	3,546
Interest 2/	Dollars	524	486	497	509	535	508	522	526
Adjusted farm income	Dollars	1,384	626	1,312	1,176	3,371	2,281	2,986	3,020
Difference	Dollars	---	---	---	---	1,987	1,655	1,674	1,844
Cost of extra family labor 3/	Dollars	---	---	---	---	502	503	430	489
Increased income, total	Dollars	---	---	---	---	1,485	1,152	1,244	1,355
Increased income, per acre	Dollars	---	---	---	---	9.28	9.22	8.88	9.22

1/ Water costs and interest not included.
2/ At 5 percent, excluding investment in land.
3/ At $1.00 per hour.

Table 11D.- Weighted average value of production and annual production costs, except land and water, for projected farm budgets on the basis of crop sales only, evaluation areas D and E, Smith Fork project

Farm type	Units	Evaluation area D	Evaluation area E	
		With project	Without project	With project
		Feeder steers	Feeder steers and sheep	Feeder steers and sheep
Irrigated land	Acres	160	140	140
Operator and family labor	Hours	2,093	1,518	1,716
Receipts	Dollars	9,045	6,986	7,895
Expenses 1/	Dollars	4,658	3,885	4,050
Farm income	Dollars	4,387	3,101	3,845
Interest 2/	Dollars	546	507	519
Adjusted farm income	Dollars	3,841	2,594	3,326
Difference	Dollars	3,841	---	732
Cost of extra family labor 3/	Dollars	2,093	---	198
Increased income, total	Dollars	1,748	---	534
Increased income, per acre	Dollars	10.92	---	3.81

1/ Water costs and interest not included.
2/ At 5 percent, excluding investment in land.
3/ At $1.00 per hour

Table 12.- Estimated weighted average cost per acre for land and farm irrigation system 'with' and 'without' the project, Smith Fork project

Item / Evaluation areas	Unit	Without project						With project					
		A	B	C	D	E	Total	A	B	C	D	E	Total
Land area	Acres	1,796	2,234	3,017	540	653	8,240	1,796	2,234	3,017	540	653	8,240
Capital investment:													
Irrigated land	Dollars	120	120	80	-	120	104	120	120	80	-	120	104
Irrigable land	Dollars	10	10	10	-	-	10	10	10	10	10	-	10
Additional capital investment:													
Irrigated land	Dollars	---	---	---	-	-	---	19	23	10	-	3	15
Irrigable land	Dollars	---	---	---	-	-	---	59	53	56	48	-	55
Total weighted average investment	Dollars	109	109	74	-	120	96	132	138	88	58	123	112
Annual interest cost 1/	Dollars	5.45	5.45	3.70	-	6.00	4.80	6.60	6.90	4.40	2.90	6.15	5.60
Difference	Dollars	---	---	---	-	-	---	1.15	1.45	.70	2.90	.15	1.10

1/ Five percent.

Development Period

Benefits from the use of supplemental water would begin to accrue immediately after completion of project works on the presently irrigated land. The 780 acres of nonirrigated land which lies in small scattered tracts are projected to be developed in conjunction with land already under cultivation. It is likely that the development work required on presently irrigated land and on the adjoining nonirrigated land would be accomplished in stages, a portion of the farm being treated each year. Development of the 540 acres of non-irrigated land, on which new farms are projected to be established, is likely to proceed rapidly after work is begun. However, several years may elapse before the full level of benefits is attained. The assumption is made for the Smith Fork project that a period of three years for evaluation areas A, B, C, and E and five years for evaluation area D will be required before the full level of projected benefits are achieved. These periods are used for discounting purposes.

Irrigation farming and development of new farms require considerable capital, labor, and management. Difficultires in farm development are frequently the result of capital limitations. Farmers have demonstrated that good production rates can be achieved within two or three years provided the resources, especially capital, are available to develop the land and to obtain the necessary equipment, livestock and buildings.

Total needs for new capital will not be excessive on the Smith Fork project. Since this is primarily a supplemental water project the present capital resources of existing farms will be utilized. The need for new capital will consist primarily of capital for land development, expansion of livestock numbers, modernization or construction of dairy buildings, and purchase of modern dairy equipment.

Annual Direct Benefits

The increased annual value of agricultural products, the annual costs of farm irrigation systems and land development, and the gross and net direct agricultural benefits are summarized in table 13. Gross direct agricultural benefits per acre for evaluation areas A, B, C, D, and E are estimated at $10.96, $10.73, $8.52, $8.02, and $3.66, respectively.

A discount factor is applied to gross direct benefits to ascertain the net direct benefits. This discount factor is dependent upon the development or waiting period necessary for full realization of the projected production and incomes for the project. A three-year development period is assumed for evaluation areas A, B, C, and E and a five-year period for D. The interest rate is five percent and the evaluation period is 100 years.

The present annual equivalent value of direct agricultural benefits for evaluation areas A, B, C, D, and E are estimated at $10.44, $10.22, $8.12, $7.29 and $3.49 per acre, respectively.

Table 13.- Summary of expected annual direct benefits and associated development costs, by evaluation areas, Smith Fork project

Evaluation area	Land area	Increased annual value of agricultural products		Annual costs of additional land development		Gross direct benefits		Discount factor 1/	Net direct benefits	
	Acres	Per acre	Total	Per acre	Total	Per acre	Total		Per acre	Total
					Dollars					
A	1,796	12.11	21,750	1.15	2,065	10.96	19,685	2/ .95271	10.44	18,754
B	2,234	12.18	27,210	1.45	3,239	10.73	23,971	2/ .95271	10.22	22,837
C	3,017	9.22	27,817	.70	2,112	8.52	25,705	2/ .95271	8.12	24,489
D	540	10.92	5,897	2.90	1,566	8.02	4,331	3/ .90844	7.29	3,934
E	4/403	3.81	1,535	.15	60	3.66	1,475	2/ .95271	3.49	1,405
Total	5/8,240	10.22	84,209	1.10	9,042	9.12	75,167		8.67	71,419

1/ At 5 percent. Present annual equivalent value per $1.00 of benefits accruing during a 100-year period.
2/ Assumes a 3-year development period.
3/ Assumes a 5-year development period.
4/ Excluding 250 acres of land in evaluation area E which are projected to receive essentially the same supply of irrigation water 'with' and 'without' the project.
5/ Includes the 250 acres, footnote 4.

Findings

Direct agricultural benefits attributable to project irrigation water are calculated on the basis of farm budgets. For analytical purposes, livestock and associated incomes are omitted. This approach eliminates an income and benefit problem related to processing feed through livestock and allocating returns to the appropriate resources. Operator and family labor and management are evaluated in the same manner as other resources.

The residual approach is used to estimate direct agricultural benefits from project water. The total income is allocated among the various claimants, with water being the last claimant in terms of a return.

Based upon the above procedure the weighted average net direct agricultural benefits for the Smith Fork project, consisting of 8,240 acres, amount to $8.67 per acre or a total of about $71,400 annually.

CHAPTER III

RELATIONSHIP OF THE SMITH FORK PROJECT TO THE MANAGEMENT, PROTECTION, AND USE OF THE GUNNISON NATIONAL FOREST AND OTHER FOREST RESOURCES

This section of the report considers the impact of the Smith Fork project on the Gunnison National Forest and on other forest and rangelands. It is aimed at determining what facilities, resources anduses will be affected and at evaluating these effects.

The proposed project features, including Crawford Dam and Reservoir, Smith Fork Diversion Dam and Feeder Canal are entirely outside the exterior boundary of the Gunnison National Forest. The proposed Crawford Reservoir is at a distance of three to six miles from the national forest boundary; the diversion dam on Smith Fork is 2 3/4 miles below the boundary. There are no forested lands, either federally or privately owned, within the 420 acre flowage area of the reservoir.

Present Status and Anticipated Future Use Without Project Development

Current Management

The forest area involved within the watershed is under good administrative management and protection which is compatible with the proposed project.

Present Use

The area is used primarily for forestry purposes of growing timber, forage, and water production. Use of the watershed area will continue at the present level until access is extended deeper into the national forest. The timber cut will probably increase. On the national forest, 14 permitees graze 1,140 cattle and horses, and 3,535 sheep during the short summer season. Private and public domain lands are also grazed but at different times of the year.

Recreation use is considered moderate and consists principally of picnicking, fishing and hunting. It is estimated this use now amounts to 3,700 visits annually.

Three reservoirs and five water diversions and ditches, authorized under special use permits and U.S. Department of Interior easements, are within the national forest. These have been taken into consideration in project planning and will be continued.

There are numerous other uses of forest resources on the watershed, including recreation, wildlife, mining, and water supply but the project will have no significant effect on these uses.

Impacts of Project Construction and Operation on the National Forest

Existing Facilities

Project construction and operation will not affect any existing Forest Service developments, improvements or services now provided.

General Administration

The project will have no significant impacts on the Gunnison National Forest or on services it provides and will not require any change in principles or objectives of administration or management. No changes or additions will be necessary in forest improvements needed for administration or services now provided on the national forest.

Protection

No additional improvements for fire prevention or control will be needed.

Resource Use and Development

The proposed Crawford Reservoir will attract visitors for picnicking, boating, and fishing at the reservoir. Some of this increased recreational use will probably also be extended to national forest lands. However, this increased use is not expected to be heavy and costs of preparing or extending recreational area plans will not be significant.

There will be no conflicts with forest areas such as wilderness, research, or other special areas.

Losses or Benefits to Resource Values

The project will have no effects on forest resource volumes or values.

Impacts on Other Forest and Forest Rangelands

There will be no effects on nonfederal forest and rangelands. Flooding of the privately owned rangelands will not affect any grazing permits or grazing use of national forest lands. The forest-based economy will not be affected. Recreational use will occur around the reservoir and will contribute to the local economy.

Findings

As far as can be foreseen at this time, the project will not impair or affect any existing facility or service on forest lands. There will be no appreciable losses or gains in resource values now provided by forest and rangelands of the national forest.

CHAPTER IV

THE RELATIONSHIP OF WATERSHED CONDITIONS TO THE SMITH FORK PROJECT

Watershed conditions covered in this report are common to most western irrigation projects. They do not materially affect feasibility of the project. However, improvement of watershed conditions and alleviation of local problems will extend the life of the project and reduce operating difficulties and maintenance expenses. These conditions are pointed out so that local, state and federal agencies which deal with watershed lands can align their regular and special programs to the eventual solution of these problems.

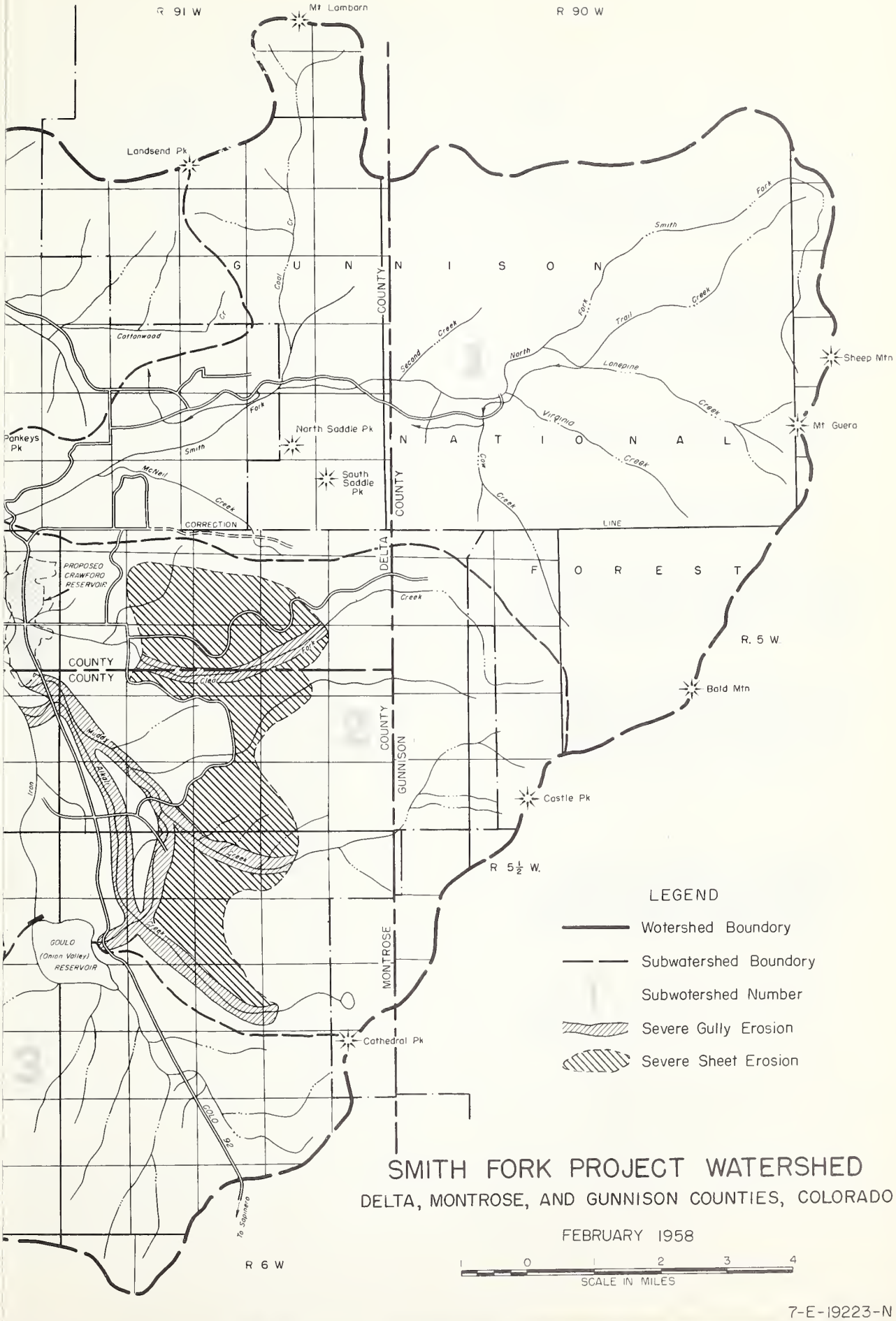
Location and Size

The watershed area comprises the drainages of the Smith Fork River, Allen Gulch, and Cottonwood Creek in Delta, Montrose, and Gunnison counties, Colorado. Smith Fork River drains the area east and south of the Crawford Reservoir into the Gunnison River. Allen Gulch and Cottonwood Creek drain the high mesa area above the Smith Fork River into the North Fork River. Most of the project lands are located in the Cottonwood Creek and Allen Gulch drainages.

The area is divided into subwatersheds as shown in table 14 and on the watershed map.

Table 14. - Subwatersheds, Smith Fork project

Subwatershed number	Drainages	Square miles
1	Smith Fork River above the mouth of Iron Creek	73
2	Iron Creek between Gould Reservoir and Crawford Reservoir	52
3	Iron Creek above Gould Reservoir	14
4	Smith Fork River below mouth of Iron Creek	60
5	Allen Gulch (including project lands)	25
6	Cottonwood Creek (including project lands)	41
	Total	265


R 91 W
Mt Lamborn
R 90 W
Landsend Pk
Cr
Cattonwood
Cr
Coor
G U N N I S O N
COUNTY
Second Creek
North Fork
Smith Fork
Trail Creek
Lonepine Creek
Virginia Creek
Sheep Mtn
Mt Guero
Pankeys Pk
Smith Fork
North Saddle Pk
South Saddle Pk
McNeil Creek
Cave Creek
N A T I O N A L
F O R E S T
CORRECTION LINE
DELTA COUNTY
PROPOSED CRAWFORD RESERVOIR
Creek
R. 5 W
Bald Mtn
COUNTY
COUNTY
Fork
Creek
Hubbard Creek
Iron Creek
GUNNISON COUNTY
Castle Pk
R 5½ W.
GOULD (Union Valley) RESERVOIR
MONTROSE
Cathedral Pk
GOLD 92
To Sapinero
R 6 W
LEGEND
Watershed Boundary
Subwatershed Boundary
Subwotershed Number
Severe Gully Erosion
Severe Sheet Erosion
SMITH FORK PROJECT WATERSHED
DELTA, MONTROSE, AND GUNNISON COUNTIES, COLORADO
FEBRUARY 1958
0 1 2 3 4
SCALE IN MILES
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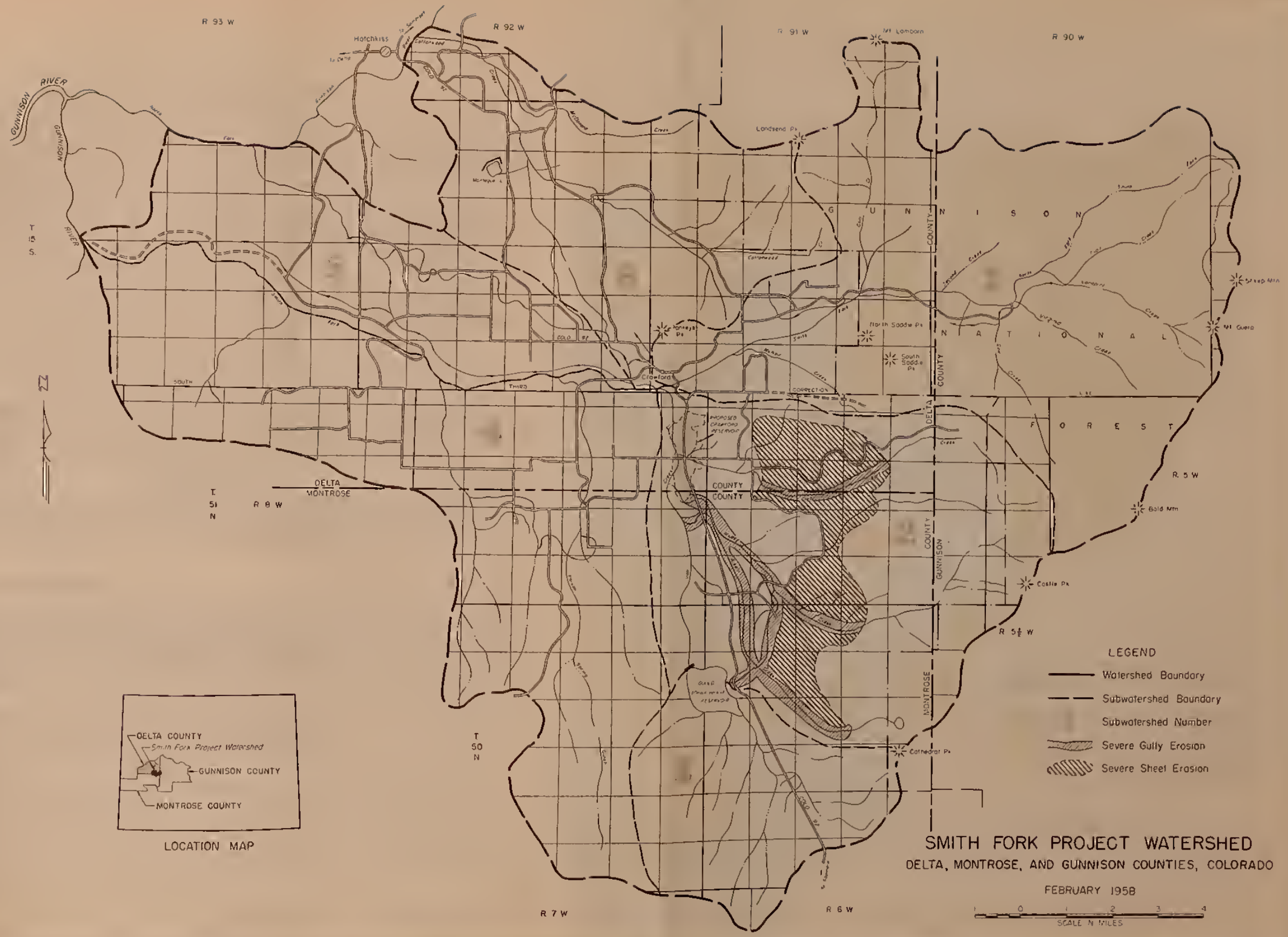

LOCATION MAP

LEGEND

- Watershed Boundary
- Subwatershed Boundary
- Subwatershed Number
- Severe Gully Erosion
- Severe Sheet Erosion

SMITH FORK PROJECT WATERSHED

DELTA, MONTROSE, AND GUNNISON COUNTIES, COLORADO

FEBRUARY 1958

SCALE IN MILES

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE ... IM 1926

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Watershed Characteristics

Topography and Geology

The topography of the watershed ranges from an area of gently sloping mesas and benches to steep and very steep mountainous land along the upper Smith Fork River.

The mesa area consists of two parts whose drainage is divided between the Smith Fork and the North Fork Rivers. The south mesas are drained by Iron Creek and Poison Spring Gulch into the Smith Fork River. The Smith Fork River flows westward along the base of the sharp cliff that separates the two areas.

An uplift forms the north mesa area commonly referred to as Grandview Mesa and Missouri Flats. These mesas are drained by Allen Gulch and Cottonwood Creek.

Other project lands are located south of the Smith Fork River and east of Crawford Reservoir. A few small fields are located in the canyon bottom.

The Crawford Reservoir site is on Iron Creek just above its confluence with the Smith Fork River. Iron Creek drainage is characterized by some relatively flat alluvial bottoms surrounded by a large area of steeply rolling to steep, hilly terrain and raw shale escarpments.

The major portion of the lower watershed area is Mancos shale formation. The high mountains at the upper reaches of the Smith Fork River are made up of early Tertiary intrusive rocks, while the high mountains at the head of the Iron Creek drainages are formed from a volcanic agglomerate and breccia.

Precipitation and Runoff

The average annual precipitation varies from about eleven inches at Crawford to nearly thirty inches in the higher mountains. Approximately 50 percent of the precipitation is received as snow. The month of June receives the least precipitation. Some high-intensity rainstorms occur in July, August and September.

Flood stages can be expected from snow melt during May and June, and from high-intensity rains in July, August and September.

Vegetation

Vegetative cover by principal type and condition is shown in table 15.

Table 15. - Watershed condition by vegetative types, Smith Fork project

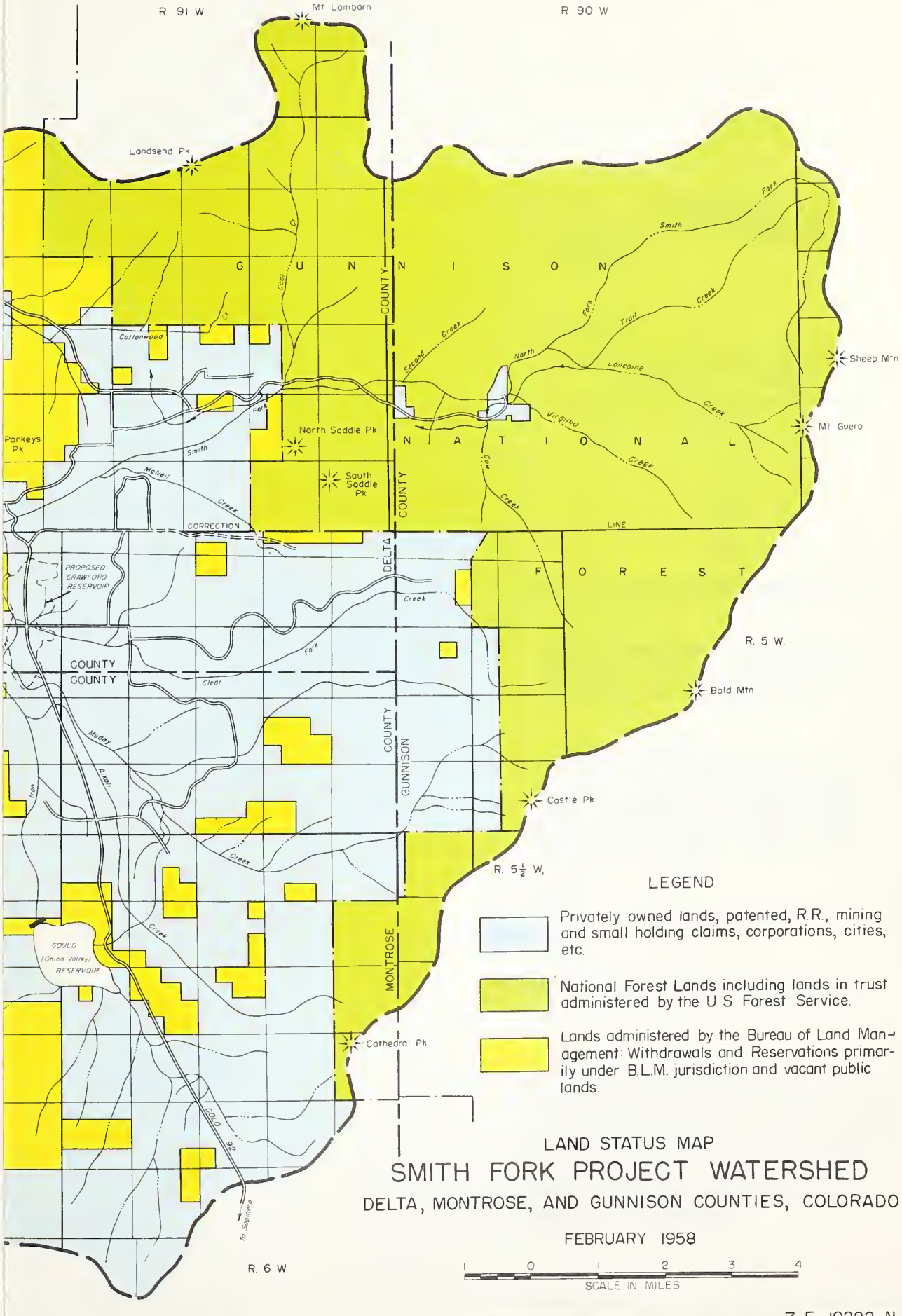
Principal vegetative type	Plant cover conditions			
	Good	Fair	Poor	Totals
	- - - - - - - - - - Sq. miles - - - - - - - - -			
Dense conifer timber	2	--	--	2
Open confier timber	3	--	--	3
Aspen	28	--	--	28
Oak brush	45	15	--	60
Other mountain brush	12	38	--	50
Sagebrush	--	1	26	27
Grass	--	3	12	15
Pinon-juniper	--	--	29	29
Subtotal	90	57	67	214
Barren	--	--	--	15
Cultivated land	--	--	--	36
Total				265

Soils and Erosion

The drainages are characterized by steep slopes with thin soil cover. Deeper soil is found in the narrow valley bottoms. The main streams have a low gradient while the feeder tributaries are steeper. Lands with poor and very poor vegetative conditions are losing soil. Sheet erosion is prevalent with active gully erosion in certain areas.

Lower elevation rangelands have severe sheet and gully erosion. Some of the area is so sparsely vegetated it is considered barren. Much of the mixed shrub-type appears to have a good cover but does not afford soil protection against erosion because litter and residue are lacking.

Gully eorsion not only results from poor vegetative cover but from the practice of using natural waterways to transport irrigation water. Many of these waterways were not sufficiently vegetated to handle the flow of irrigation water. Past practice has been to use a waterway until it became severely gullied and then divert irrigation water to another waterway. Consequently several gullies have been caused by one ditch.



LEGEND

Privately owned lands, patented, R.R., mining and small holding claims, corporations, cities, etc.

National Forest Lands including lands in trust administered by the U.S. Forest Service.

Lands administered by the Bureau of Land Management: Withdrawals and Reservations primarily under B.L.M. jurisdiction and vacant public lands.

LAND STATUS MAP
SMITH FORK PROJECT WATERSHED
DELTA, MONTROSE, AND GUNNISON COUNTIES, COLORADO

FEBRUARY 1958

0 1 2 3 4
SCALE IN MILES

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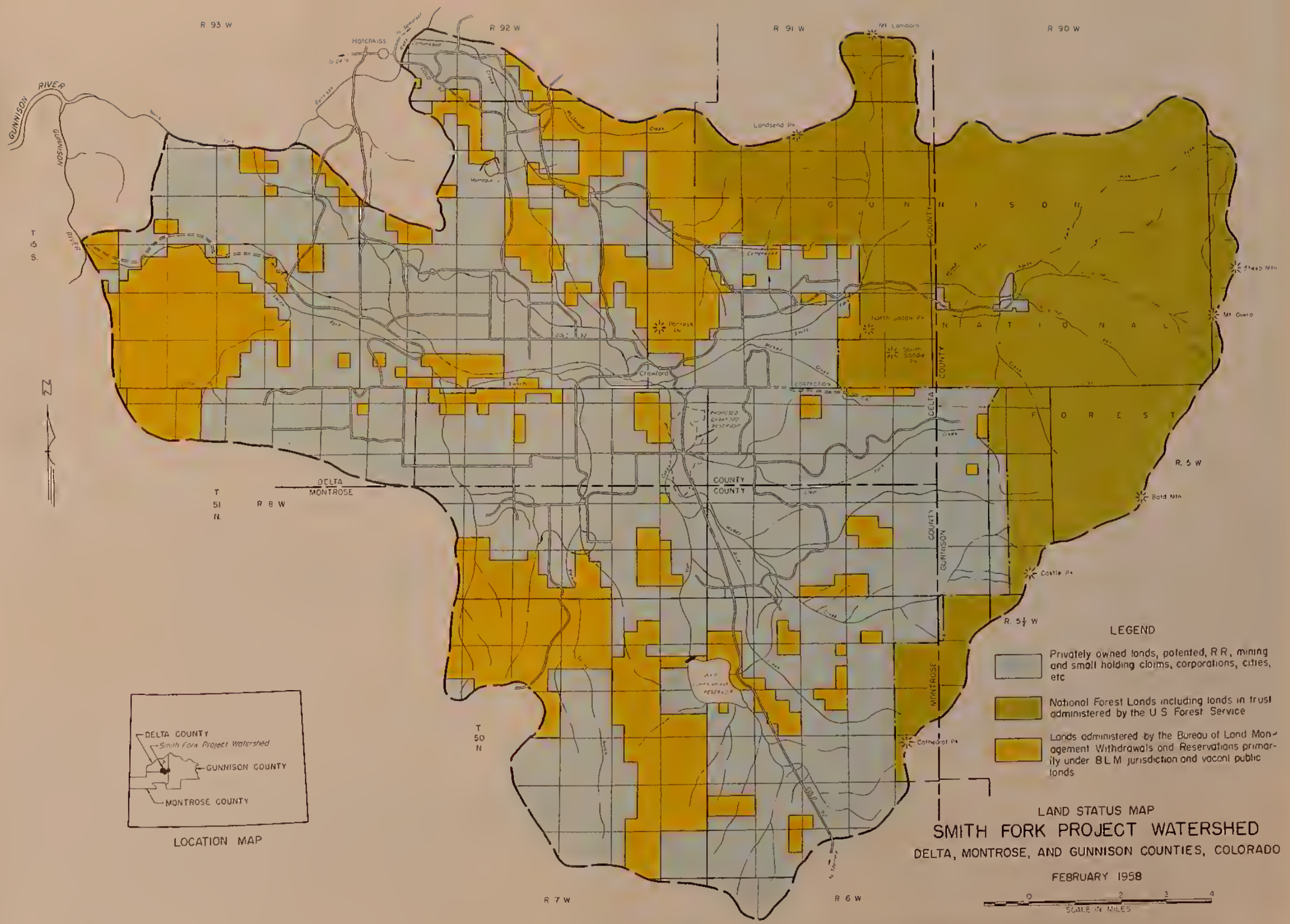

LEGEND

Privately owned lands, patented, R R, mining and small holding claims, corporations, cities, etc

National Forest Lands including lands in trust administered by the U S Forest Service

Lands administered by the Bureau of Land Management Withdrawals and Reservations primarily under B L M jurisdiction and vacant public lands

LOCATION MAP

LAND STATUS MAP

SMITH FORK PROJECT WATERSHED

DELTA, MONTROSE, AND GUNNISON COUNTIES, COLORADO

FEBRUARY 1958

SCALE IN MILES

7-E-19222-N

U S DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

Erosion on cultivated land varies from slight to severe, with the major portion being only slightly eroded.

Land Use and Land Ownership

The land ownership is shown in table 16. Private land is essentially all owner-operated. The national forest and public domain lands are generally used by farmers and ranchers living within the watershed.

Table 16. - Land ownership, Smith Fork project watershed

Class of ownership	Square miles	Percent of total
Private	146	55
Public Domain	44	17
National Forest Land	75	28
Total	265	100

The major portion of the upper watershed is federally owned and is used for grazing of sheep and cattle. Forestry, wildlife, and recreation are other uses of this area. A minor portion is privately owned and includes a few small cultivated areas.

The lower elevation lands are privately owned except for small areas of public domain. Approximately one-fourth of the private lands are cultivated. The balance is either grazing or wasteland. The wasteland is barren clay or shale. The cultivated land is irrigated hay and grain land. The grazing land in this zone consists of pinon, juniper and foothill shrub types, and is also used for spring-fall range by deer and elk.

Watershed Problems

General watershed characteristics and problems are described by subwatersheds shown on the watershed map.

Subwatershed No. 1

The subwatershed comprises the drainage area on the main Smith Fork River from the junction of Iron Creek to the high mountain peaks. National forest lands with generally good vegetative cover make up the majority of the lands. Flooding has caused some damage to irrigation company headings and other private property in years of excessive runoff. If vegetative cover condition can be maintained or improved, little additional damage is anticipated.

Subwatershed No. 2

This subwatershed is the area on the Iron Creek drainage from Gould Reservoir to the Crawford Reservoir including the drainages of the Mud, Alkali and Clear Fork Creeks. Vegetative types are principally pinon-juniper, sage and oak brush. Vegetative cover is generally fair to poor and large areas of sheet erosion are in evidence. Numerous water sources have been badly gullied by being used as irrigation ditches and not properly stabilized. Most of this area is privately owned.

Floods are frequent and sediment yields are high. No project lands will be flooded but large amounts of sediment will be deposited in Crawford Reservoir. Construction plans for the reservoir provide sediment storage but any erosion control or reduction of sediment will lengthen the life of the reservoir. This area is the most critical one in its effect on the project.

Subwatershed No. 3

The subwatershed comprises the drainage area above Gould Reservoir. None of the floodwater, silt or irrigation water will endanger project lands.

Subwatershed No. 4

The subwatershed includes the Smith Fork drainage below the mouth of Iron Creek and Poison Spring Gulch with some other small tributaries. Only small parcels of project lands will be affected by runoff.

Subwatershed No. 5

The subwatershed consists primarily of Grandview Mesa and includes a large portion of the project lands. This mesa is several hundred feet directly above the Smith Fork River so is in no danger of flooding.

Subwatershed No. 6

This subwatershed, the Cottonwood Creek drainage, contains the lowest elevation lands. Vegetative cover is poor, and runoff and sediment yield high.

Cottonwood Creek has been used in the past to convey flood and irrigation water. This has resulted in transforming the creek into several large gullies. The creek has ample capacity to carry expected flows without flooding adjacent cultivated lands. There are a few areas where bank cutting may endanger fields. Control methods include stream bank protection, the leaving of a berm area between the gully and the field edge, and proper disposal of waste irrigation water.

Land Treatment

Federal Lands

National Forest Lands

Protection and conservation measures on national forest lands can be accomplished by proper land use and proper management of all resources. The greatest amount of protection will be accomplished through proper range management. The first need is to complete the range analysis survey. This program is being carried out as rapidly as forest funds and unit management time permits.

The Forest Service is conducting a soil survey on national forest lands on the Gunnison National Forest in Gunnison County. This survey will obtain valuable basic data for land management planning on national forest lands. Special provisions for timber cutting will not be necessary for it will be accomplished in a manner not detrimental to the watershed. Location of roads or ditches within the national forest should be given careful consideration. Extreme care should be given to proper location of such improvements to prevent unnecessary erosion.

Public Domain Lands

The greater portion of the public domain lands consist of scattered isolated tracts. These are predominately used for the grazing of livestock by operators of adjoining private lands. Ownership is expected eventually to be transferred to adjoining landowners. While these lands remain in federal ownership, the Bureau of Land Management will complete the range analysis studies on them and make any indicated adjustments in grazing use required to secure necessary watershed protection.

Private Land

Conservation and improvement measures center around range and water management programs. The Soil Conservation Service through the Delta Soil Conservation District has assisted in the installation of some improvement work in the area, including improvement of irrigation ditches, installing irrigation structures, and building stockwater ponds. Work has been somewhat limited because of deficient irrigation water and the resulting low financial returns from farm operations. Only a small number of landowners within the project have signed cooperative agreements with the district. Soil Conservation Service technicians have worked with some of the ditch companies in planning and application of improvements. Five such companies were assisted in recent years with major improvement works.

In general, the attitude of the people in the project toward conservation is improving. Much conservation and improvement work needs to be done. As the economic conditions of the area improve the conservation activities will accelerate.

Treatment of watershed lands, tributary to the Smith Fork project, is recognized as being important to the control of erosion and sediment. A primary objective is to improve vegetative and soil condition.

Estimates of recommended land treatment measures are shown in table 17.

Table 17. - Recommended land treatment, 1/ Smith Fork project watershed

Treatment	Unit	Estimated amount		
		Private land	Federal land	
			B.L.M.	F.S.
Proper use of range forage	Ac.	63,000	26,000	48,000
Stockwater development	No.	144	10	10
Water spreading & gully control	Ac.	800	5,000	200
Fences for grazing distribution	Mi.	40	8	4
Brush & weed control	Ac.	1,800	1,000	---
Establishment & improvement of irrigated pasture	Ac.	6,000	---	---
Range reseeding	Ac.	1,200	1,000	500
Reorganization of ditch systems	Mi.	102	---	---
Land leveling and grading	Ac.	1,500	---	---

1/ Excluding project lands.

Flood Prevention Structural Measures

The present Gould Reservoir on Iron Creek, about four miles above the Crawford Reservoir site, decreases flood peaks and sediment damage on the Iron Creek Drainage. Other existing reservoirs and ditches on the project's watershed have only minor effect on decreasing flood peaks. Due to topography, general aspect, and past flood history of the watershed, the construction of large flood control structures is not recommended. Improved management and use of watershed lands, plus related measures such as fencing, revegetation and small structure will yield better and longer-lasting results.

Irrigation Aspects

Project lands that are subject to frequent damage from flooding are the small acreages along the lower reaches of the Smith Fork River. Other drainages, Allen Gulch and Cottonwood Creek, are well channelized and danger of flooding would be remote. The Missouri Flats lands are served by irrigation ditches that receive irrigation water from a well-covered subwatershed area and therefore flooding and silting will be slight. Excessive high water at intervals has damaged irrigation ditch headings. Proper construction and maintenance will alleviate this problem. Most ditches in the watershed are eroding due to steep gradient slopes and should be corrected by the irrigation companies.

Findings

Watershed conditions do not pose a flood hazard to the project. They do produce excessive amounts of sediment which will reduce storage capacity of project reservoirs and cause canal cleaning problems. Even though the Crawford Reservoir is designed to provide storage for the current sediment production for 50 years, any reduction in that sediment will lengthen the useful life of the project. Most of the sediment comes from problem areas which can be greatly improved by watershed treatment measures. Watershed treatment can be accomplished under regular programs of federal land-administering agencies and by private landowners with assistance normally furnished by federal and state agencies. There should be greater emphasis by all interested parties on proper land management to improve watershed conditions and reduce the sediment problem. The users of watershed lands will receive sufficient benefits to justify their cooperation in this effort.

CHAPTER V

REGULAR ACTIVITIES OF THE U. S. DEPARTMENT OF AGRICULTURE PARTICULARLY AFFECTED BY THE SMITH FORK PROJECT

Introduction

The U. S. Department of Agriculture and Colorado State University are carrying out a number of agricultural activities in Delta County, Colorado. This is being done under regularly established programs. With the increased agricultural activity brought about by the Smith Fork project, these regular programs will need to be accelerated. Increased amounts of assistance from these programs will aid and accelerate the development of project lands.

Agricultural Education and Information

The Colorado Cooperative Extension Service maintains an office at Delta. The services of a resident extension agent, assistant extension agent, home demonstration agent, and the nonresident specialists located on the campus at Fort Collins are available to farmers in the project area. Additional information and educational services will be required. This is particularly true in connection with any expansion in the dairy and livestock industry. Additional information and education in connection with better irrigation water management and pasture development will also be needed.

Technical Services

The Smith Fork project lies within the Delta Soil Conservation District. The Soil Conservation Service has a work unit at Paonia staffed with a work unit conservationist and an engineering aid. Other Soil Conservation Service assistance is available through their offices at Delta, Montrose and Grand Junction, including specialist assistance in soils, engineering, agronomy, biology, range and woodland management.

Additional technical services and on-site assistance from Soil Conservation Service technicians will be required in connection with the planning and application of conservation measures, such as land leveling, farm irrigation systems, water management, grass management, soil fertility management and drainage.

Farm Financing

At the present time there is one active operating Farmers Home Administration Loan in the project area. There are no Farm Ownership, Farm Housing, or Soil and Water Conservation loans in the project area at this time. Farmers Home Administration Loan programs have been limited due to inadequate irrigation water supplies. The present stream flow water rights provide dependable full season irrigation water to only a limited number of farms having earliest decrees and being favorably located with respect to the irrigation ditch system.

When reservoir storage is provided and full season irrigation water supplies are assured, it is expected that Farmers Home Administration loans will be in demand. Farm enlargement type loans will be needed to round out economic units, and farm development loans for land and building improvements will be needed. Soil and Water Conservation loans for land leveling, soil conservation practices as well as irrigation water developments will be needed on individual farms. Farm operating loans will be needed by a considerable number of farmers to assist making adjustments in farming operations by increasing livestock herds and farm machinery. The above farm adjustments and improvements needed will in many cases require long-term credit that cannot be supplied by local commercial credit sources.

Cost-Sharing for Conservation Measures

The rural economy of Delta County is largely dependent upon the available supply of water for irrigation. Completion of the Smith Fork project will assure an adequate and dependable supply of irrigation water for the farms served by the project. This in turn will necessitate the reorganization of many of the individual farm irrigation systems to make more efficient and profitable use of the water and soil.

To aid in the development of these and other conservation measures, the Delta County Agricultural Stabilization and Conservation Committee offers cost-sharing through the Agricultural Conservation Program to participating farmers and ranchers.

It is anticipated that the completion of the project will greatly increase the progress in the land leveling and irrigation improvement phases of the program in the area and additional funds for cost-sharing will undoubtedly be required. The need for technical assistance in connection with such practices will likewise increase.

The resultant improvement in operations, productivity, and farm values will be reflected in more prosperous economic conditions in both rural and urban areas.

National Forest Land

Inasmuch as the proposed project features and project lands are all outside of the exterior boundary of the Gunnison National Forest, the project will have relatively little effect upon the regular program of the Forest Service. This going program on national forest land includes measures for the restoration and proper management of plant cover and the maintenance of soil stability. These activities will aid the general watershed protection objective of reducing floodwater and sediment hazards to project installations and their maintenance.

Research Needs

A comprehensive report covering general research needs for the area of the Colorado River Storage Project will be developed by representatives of the U. S. Department of Agriculture research agencies, state agricultural colleges, and experiment stations. As far as the Smith Fork project is concerned, there appears to be no research needs peculiar to this project that would not be covered in the above-mentioned report.

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